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the engineer

Spring, 1971

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We

We of the Corps of Engineers have long been waiting for the advent of a forum to air our ideas on current Engineering problems—military problems as well as those within the civilian domain.

We are optimistic that we now have such a vehicle, with the initial issue of THE ENGINEER, making its debut on the engineering scene.

Through this medium, we hope to trigger engineer thinking. We hope to stimulate controversial subjects; "cross-generate,"—if you will—engineer viewpoints, with the objective in mind of progress in the profession. Certainly there are among us engineers who can rebut or reply to questions such as:

"Should Engineers be generalists or specialists . . . ."

"Can we attain trade union recognized proficiency for our MOS specialists . . . ."

"What is the best method of reducing response time . . . ."

We would like to see such topics—and countless others, explored and we believe that this can be done effectively through future issues of THE ENGINEER.

Controversy for controversy sake? No—that is not our objective. What we are after is progressive engineering thought, and we feel that we shall be successful in reaching that goal. We see THE ENGINEER as a reflection of contemporary thinking engineering-wise. It will be edited with the aim of provoking the thought processes of the complete span of our personnel, from young enlisted men to career-oriented engineer officers. From them may well emanate new ideas, fresh approaches to existing problem areas—solutions perhaps, to many of the technical barricades facing us.

With that in mind, an epigram occurs to us (and we are speaking in terms of engineering problems):

"PROBLEMS KNOWN BY ALL, ARE PREVENTED FROM GROWING TALL."

In essence, this means that discussion invites solutions, and we want to stimulate discussion in THE ENGINEER.

Remember, THE ENGINEER constitutes an open engineer forum. We hope that those who are in the business, will give us the business ! ! ! Your help is solicited. Input is desired from all engineers who wish to serve the interests of our Army and nation.

Let us hear from you ! ! !

MG Robert R. Ploger
Commandant, U.S. Army Engineer School

e
designed for
professionals

U.S. Army
Engineer School
Fort Belvoir, Virginia

MG Robert R. Ploger
Commandant,
U.S. Army Engineer School

BG Ira A. Hunt Jr.
Assistant Commandant,
U.S. Army Engineer School

COL William F. Hart Jr.
Deputy Assistant Commandant,
U.S. Army Engineer School

Editor:
MAJ Tommy B. King
Executive Editor:
1LT J. H. Walker III
Circulation Manager:
CPT Tom Trivan
Art Director:
John W. Savage Jr.
Staff Writer:
Rodger A. Streitmatter

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Our cover photo was taken by Major Robert W. Whitehead, Liaison Officer to Southeast Asia, Office of the Chief of Engineers. His photo contrasts the old and the new in South Vietnam. Read about it in LOC, page 18.

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engineer interview:

with
brigadier general

IRA A HUNT JR

A young Corps of Engineers lieutenant supervising the construction of a road in an underdeveloped country in Southeast Asia would appear to have little in common with an atomic demolitions specialist assigned to an engineer unit in Europe. Nor would it seem that either of them would have any mutual interest with a missile equipment repairman running a final check on a piece of vital missile support equipment located on a test atoll in the Pacific. Yet all of these men have a common tie—they are all graduates of the U.S. Army Engineer School at Fort Belvoir, Virginia, the "Home of the Engineers."

The U.S. Army Engineer School is the Army's oldest military service school. It is the sixth largest graduating institution of learning in the Washington, D.C. area—until recently averaging about 25,000 graduates each year.

Its reason for being? Very simply put—to produce professionally qualified engineer officers, and enlisted personnel extremely proficient in related engineering skills. Their mission? For combat troops—to provide all possible engineering knowledge for progress; be it in the area of the railroad building of the 1800's (which saw this nation expand from east to west, and in so doing promoted the commercial well-being of untold thousands of its population, increased trade potential, and sped lines of communication to the point of instantaneous response which we enjoy today), or in the area of water resources planning—or the relatively new field of ecology.

Brigadier General Ira A. Hunt Jr., is the Engineer School's executive—he's the individual who, on a daily basis, directs the school's operations for the commandant of the school, Major General R. R. Ploger (who also is the commanding general of the Engineer Center and Fort Belvoir), and working closely with the Chief of Engineers,

We have done away with reveille, cut our details in half, relaxed the dress code . . . and in general enhanced the total environment.

We rely greatly on inputs from the field to tell us how to improve the quality of our students.

Instruction depends on people and we have the best. Our instructors are enthusiastic and they are knowledgeable.

Lieutenant General F. J. Clarke, General Hunt has pushed for quality in the officers assigned to duties with the Engineer School. He has been successful to a great degree.

This is understandable.

A most personable individual, charming in conversation, and most friendly socially, General Hunt belies a constant underlying concern for problems which "bug" him. Outwardly, it would appear that there is no such thing as a problem without resolution to him. He is a man who believes in a direct approach to solving problems. He is an impatient man—in a great hurry to see that problems are solved, and to his satisfaction.

He has an outstanding record of accomplishment. He is not out to make friends, as such. He is governed by an overwhelming desire to accomplish those tasks in which he believes. And he believes also that others should be as "fired up" as is he. In fact, he sees that they are.

Most who work for him for the first time are rather shaken.

He is much like a high-tension wire, severed—for all within his reach soon become charged with endeavor.

He is quite a person—and provides the current which makes the Engineer School today, an electrified organization.

He has much going for him: graduated from the US Military Academy in 1945, after two years at Vanderbilt University—MS Degree in civil engineering from MIT at Cambridge—Studied at Delft, the Netherlands, and at Grenoble, France, as a Freeman Scholar, receiving the doctor of university degree in hydrodynamics from the University of Grenoble. He has a masters degree in business administration from the University of Detroit, Michigan, and a doctorate in that field of endeavor from George Washington University in Washington, D.C.

General Hunt knows engineering. From both the civil side—and in combat. He has instructed at both the US Naval Academy and the US Military Academy at West Point, in engineering subjects. He has served as a district engineer and with the Office of the Chief of Engineers.

In Korea, he served with distinction with the Eighth Army; and in Vietnam, he earned a name for himself as chief of staff and with the First Brigade of the 9th Infantry Division as a "heluva guy" who wanted to get a job done.

Pacific Stars & Stripes reported that ". . . if not all of the 1st Brigade loved Hunt—some clearly did not—they put out for him at a remarkably high level."

It would appear to be an academic assessment, then, of this gentleman's profile as:

An intellectual with an enviable professional competence; blessed (or damned, as the reader may choose to evaluate) with an unswerving commitment to patriotic duty; brave; determined; resolute; ambitious; impatient to see that orders are fulfilled; faithful; imbued with a deep sense of integrity; and a man in one whale of an inspired hurry.

As "the man" charged with applying broad policy to the practicality of daily operations it can be well-understood why THE ENGINEER chose to interview him, for he is the "spark-plug" which ignites engineer effort today at the US Army Engineer School.

ENGR: General Hunt, what do you consider the major missions of the Engineer School?

HUNT: I think that most engineers would be interested in knowing that up to the first of February this year we were the only school in the CONARC System that had all 26 of the missions which could be assigned. Of these I would consider that we have three major missions: First, to educate and train engineers. Second, to insure that we have up-to-date doctrinal inputs in our teaching and training literature. Third, to foster the idea that Fort Belvoir is the "Home of the Engineers." Of these the last is by far our most important mission.

ENGR: Why do you say that making Fort Belvoir the "Home of the Engineers" is our most important mission?

HUNT: The majority of engineer officers who remain on active duty will be assigned to Fort Belvoir twice during their early and therefore formative careers to attend the basic and advanced courses. Now that we have a new CONARC NCO schooling program the majority of NCO's on active duty will probably be stationed at Fort Belvoir three times: for their AIT and for the new Basic and Advanced NCO Classes. Therefore, Fort Belvoir must engender in our officers and NCO's the spirit of the Army and a pride in the Corps.

ENGR: We have heard that you have a new training philosophy at the Engineer School.

HUNT: I wouldn't say it was new. We have just formulated it. Instead of focusing on teaching alone we zero in on three major aspects. First, of course, are the core subjects, those tasks that must be learned by all students. Second, we have broadened the scope of training to include electives, outside speakers and a comprehensive reading program. I would say in each of these areas Fort Belvoir has obtained distinguished results. Third, we include physical fitness, social activities and leisure time. Since most of the officers and enlisted men attending Fort Belvoir are on their way to Vietnam or have just returned from Vietnam leisure and family life are of paramount importance. Lastly, we blend these three aspects of training into one total bull's eye by adding what I call "The Engineer Spirit"—the desire to get the mission done and done well, taking pride in how we do it. This, of course, ties in very closely with our stressing of the "Whole Man Concept" in all student activities.

ENGR: Exactly what do you mean by the term "Whole Man Concept"?

HUNT: That is an expression we coined to describe the aforementioned program of providing leisure and in taking care of people—insuring that Belvoir is a good place to stay. It applies particularly these days to enlisted men. We have done away with reveille, cut our details in half, relaxed the dress code, permitted individual decoration of rooms in barracks, provided much more free time and in general enhanced the total environment. These programs have been directed by the Commandant and are fully supported by the Post staff as well as the School.

ENGR: Can you describe some changes that have occurred in the past two years?

HUNT: Yes, certainly. Major changes have occurred in all areas of instruction, so please let me single out only the Basic Course. Previously a basic officer's standing in his class was determined totally by academics. Now his grade is computed 70 percent on academics, 20 percent on leadership (to include peer ratings) and 10 percent on physical fitness. Should the newly commissioned officer fail in any of these areas he must go before the Academic Board. Additionally we have five "Go-No Go" subjects that all officers must pass. These are areas where every second lieutenant must properly perform his mission: They are Map Reading, Maintenance Management, the Combat Engineer Practical Exam, Roads and Airfields and Combat Engineer Support. We have doubled our hands-on training. The Combat Engineer Practical Exam is an excellent example of this. The young officers are quizzed on the role of a second lieutenant in the field and they must cope with seven realistic problems. In each of our 52 courses we have expanded the scope and reduced the time in class. All students now attend class only five days a week and have at least four hours off during the week, generally on the same afternoon to take care of personal affairs.

ENGR: Do you think this new program, for example, in the basic course has paid off?

HUNT: Handsomely. So far this year over 60 percent of all our lieutenants on active duty have opted for Voluntary Indefinite Status prior to leaving Fort Belvoir. We have had over 4,000 voluntary indefinite officers in the past two years. As result of this, as well as the drawdown in Vietnam, the turn-around time for company grade officers has stretched to at least four years.

ENGR: Would you explain to me then about the electives? What are they?

HUNT: The electives program pertains primarily to the Advanced Course where we have 16 electives divided into two groups of eight each 15 weeks long. These electives include graduate studies, undergraduate degree courses and courses taught by the Engineer School. Each advanced course student elects two 90 hour electives each semester. It is possible, then, for the student to obtain 12 hours of graduate degree credits with The George Washington University with whom we have a degree program or 12 hours of undergraduate degree work with the University of Virginia with whom we have an undergraduate degree program. Students with a master's degree can work on his Professional Engineer License while in the Advanced Course. Primarily our electives are in the field of management and engineering, with military oriented specialist courses for those not interested in degree work.

ENGR: With all the things that have been done to improve the Advanced Course we note that the engineer officer selection for the C&GSC has decreased. Can you explain this? And what and if anything is being done?

HUNT: Yes, it is explainable. The decrease in engineer quotas for Leavenworth is a temporary

thing. It stems from the fact that the Corps of Engineers is short of majors and the quotas for Leavenworth are predicated on the number of qualified personnel within each of the three branches: the Signal, Military Intelligence and the Corps of Engineers. To be qualified an officer must have at least eight years of service and be a graduate of his branch advanced course. During the Vietnamese buildup there was a shortage of engineers. So we all served in Vietnam and there was a decrease in the number of advanced course graduates. We have recently established two completely new programs here at the Engineer School. One is for *constructive credit*. All engineer officers on active duty with eight years of service who have a college degree and have served as a company commander are reviewed by a board of officers, headed by myself, and if their record is good they are given constructive credit. We have just completed a Board and have awarded constructive credit to 30 officers. The second program is that of *equivalent credit*. Engineer officers with a baccalaureate degree can be assigned to the Engineer School Staff and Faculty and by monitoring certain courses pass a qualification exam and receive equivalent credit for the Advanced Course. Both of these programs receive the same diploma and same credit as resident students. We have hopes of qualifying more officers, particularly when the large number of captains that we now have reach their eighth year. Thus, the engineer quotas to Leavenworth should surge upward.

ENGR: Has the Engineer School felt the impact of the drawdown in the Armed Forces?

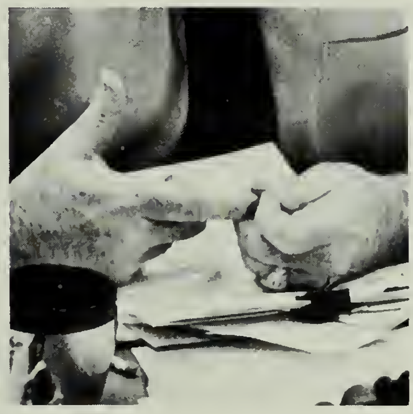
HUNT: With respect to students, the Officer Candidate School graduated its last class in December, 1970. This was a distinguished organization which was a source of great pride to all of us here at Fort Belvoir. After three years of operation the Engineer Officer Candidate Regiment graduated 10,380 second lieutenants of which 5,850 were commissioned in the Corps of Engineers. Compare this to only 2,323 graduated during the Korean War. However, for the past two years the officer and enlisted inputs have not decreased at all. Reductions in active Army students have been balanced by increases in the Reserve and National Guard students. Yet, during this period the instructor strength of the school has decreased from over 4,000 to 2,400 personnel, and our monetary inputs have decreased from about $100 per student to $50 per student. Yet, I can guarantee there has been no reduction in instruction. In fact, the instruction has improved.

ENGR: How can you say that?

HUNT: First of all, instruction depends on people and we have the best. Our instructors are enthusiastic and they are knowledgeable. That is all it takes to run a school. We also have a feedback program where sudents critique our courses. Thus, we're able to shore up our weaknesses and reinforce our strengths. I am proud that last year three of our lieutenant colonels were selected to go to the senior service colleges. Yes, the quality of our instructors, officer and NCO alike, is great. I am not talking about their degrees or their schooling but about their performance and their capabilities.

ENGR: Is there anything else you would like to add, General Hunt?

HUNT: Yes, I would like to bring out just one more point. We are no longer stressing teaching at the Engineer School; our interest is on learning by the student. We are student oriented. We want these students to go out to their jobs in the Army and in engineer units with a feeling of confidence and with the highest of esprit. We rely greatly on inputs from the field to tell us how to improve the quality of our students. The Engineer School doesn't belong just to Fort Belvoir—it belongs to the whole Corps. After all the Engineer Center is the "Home of the Engineers."

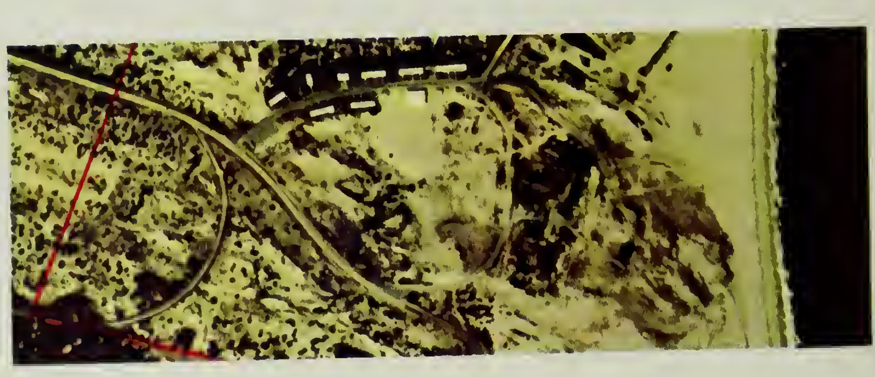


THE GREAT DUNE

Henlopen Point juts into the Atlantic Ocean two miles north of Lewes, Delaware. On this peninsula stands the largest sand dune on the Delaware coast.

A windblown sand formation, the Great Dune is located on Fort Miles, which serves as the First U.S. Army Recreation Center.

Each summer, hundreds of military personnel break away from the Eastern shore megalopolis and take to the beautifully sloping sand of the Army's



This 1969 aerial photograph pictures the Atlantic Ocean shoreline (far right), the Army's housing facilities (top center) and the Great Dune just below the buildings (center).

Cape Henlopen recreational facility. Families fill the 26 housing units to capacity; there are many more requests for reservations than can be filled.

The Army shares the peninsula with Delaware's Cape Henlopen State Park. During the past several years, the U.S. Army has returned 1,200 acres to the State of Delaware leaving approximately 190 acres for Army use.

Charges of Army neglect and damage to Cape Henlopen arose after expansion of housing facilities in the recreation area. Press accounts of preparation of trailer sites, and subsequent statements by public officials, suggested the Army "leveled" a 70-foot dune.

A 20-foot depression was formed by wind eddies. Wind came down over the recreation center's buildings and into the sand. As this swirling wind scooped up the sand, a depression formed.

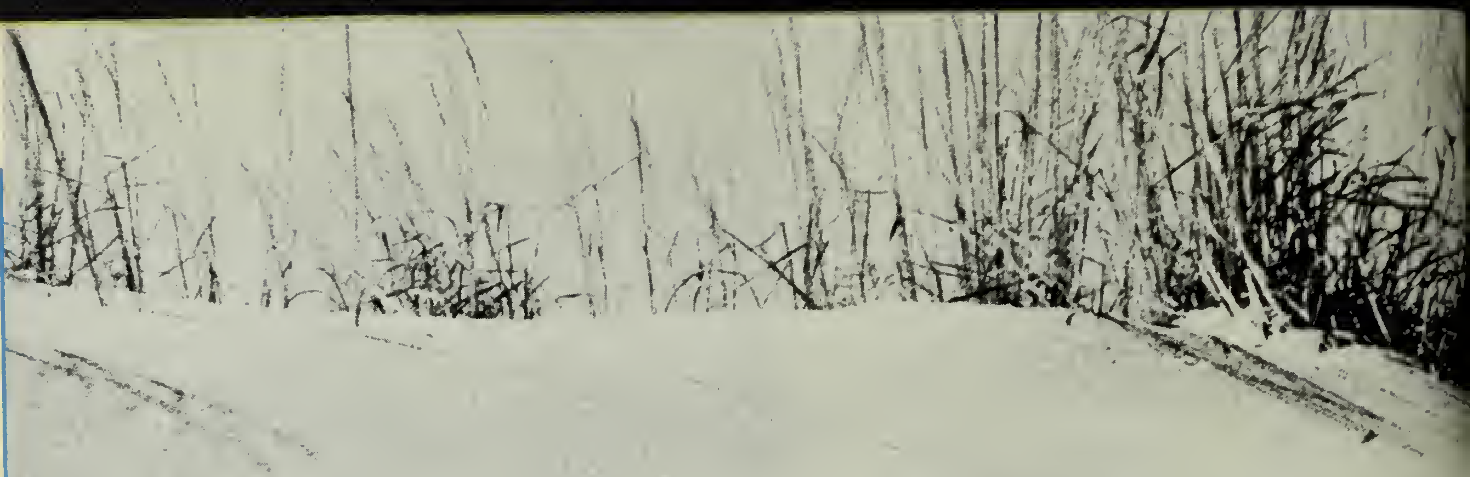
The Army attempted to fill this depression and provide a level contour once more. Plans called for ten house trailers to be placed here so more families could be accommodated during the summer.

Because of the recent national concern with ecology, the Army has taken a long look at the Great Dune.

"We in First Army are completely cognizant of the natural beauty and value of the dune. We are taking all prudent steps possible to insure the proper management of the area," commented retired Lieutenant General Jonathan O. Seaman, former commanding general of the First United States Army.

Steps toward stabilization have included planting vegetation, erecting snow fences and emplacing a bulkhead on the shoreline. Minus these conservation measures, erosion's toll would have been far more detrimental.

Army policy notes the importance of conserving sand dunes and that dunes play a



significant role in preserving seashore environment. At Cape Henlopen, that policy was exercised even before it was made explicit in a 1966 Army regulation.

Aerial photography of the area taken in 1938 shows bare, windblown sand without structures or vegetation. Just prior to World War II, a massive reinforced concrete coast artillery gun emplacement and a row of one story concrete block buildings were constructed. They arose in the area now used by the Army recreation center. Since 1944, two developments have changed the picture.

First, vegetation has grown over the dune area. Beach grass, heather and scrub pine, planted by Army engineers, preserve the dunes and enhance their beauty. Recent data reveals 45 per cent of the ground on the north slope is covered. Significant coverage was also noted in other areas. Vegetation provides a major stabilizing influence on dune movement.

Furthermore, buildings along the northern edge of the dune and shoreward from the artillery emplacement stabilized that area. Acting as a windbreak, the buildings cause an accretion of sand on the crest of the dune. This prevents further southward creep of the sand covered area in the building's vicinity. The joint influence of the artillery emplacement and buildings, when coupled with the ocean breezes, created the 20 foot depression on the crest of the dune.

Sand was taken in a layer, largely from the east and west of the depression along the longitudinal axis of the dune and from the inner surface of the southern crest. This lowered the profile of the dune behind the gun emplacement by about seven feet near the centerline. Profile elevations on the south side, across the dune from the recreation center buildings and trailers, remained about the same.

The Great Dune has by no means been destroyed by Army bulldozers. The depression was filled with sand pushed from the side of the dune. Vegetation in that immediate area was destroyed because of the displaced sand. However, filling the depression helped stabilize the dune. Neither the dune's height nor its profile was significantly altered by the operation; new vegetation has been planted.

Originally, plans called for ten trailers to be emplaced in the area. However, because of adverse publicity, only five of the trailers have been installed to accommodate visitors.

Average rental price is seven dollars per day per family. For the past six years, all units have been reserved to their maximum capacity for the entire summer season. This amounts to thousands of people annually having the opportunity to spend seven days of their leave time at a beach resort within their financial means.

A large number of military personnel and their families also visit the beach on a daily basis.

Although permanent housing facilities are reserved for military personnel, the beach and dunes are open to the public. This allows the general public to enjoy the area's recreational utility and natural beauty.

Recreational activities at Fort Miles are financed by the Command Welfare Fund, which is comprised of non-appropriated funds available to First Army headquarters. Non-appropriated funds are derived from profits made by the post exchange and other Army activities. No tax revenue is used to support these activities.

The Fort Miles Military Reservation serves as an important training site for Army Reserve units. Gently sloping beaches are ideal for training crews of amphibious vehicles used in across-the-beach operations.

Plans are now being made to rehabilitate the 20-position rifle range at Fort Miles so Delaware-based Army Reserve and National Guard units can conduct annual rifle qualifications at Fort Miles. This would save time and expense for transportation; the current site is Fort Meade, Maryland.

First U.S. Army uses 13 acres for recreation; the remainder is used for training. The Army has not only turned over most of the land and buildings to Delaware, but has loaned supplies and equipment to its Parks Department.

Recreational use of seashore land by anyone will create some disruption of the environment; experience of private developers and governmental units in nearby coastal areas proves this. But there is little doubt that the dunes at Cape Henlopen are the largest along the Delaware coast and among the best preserved due to the ecological endeavors of the U.S. Army.

—Housed in the former Naval Radio Station facility, the 68th Transportation Platoon is permanently stationed at Fort Miles. Because it is located at Fort Miles, the unit can move its heavy amphibious vehicles to the beach without traveling on state-owned roads or park land.

The unit moved to Fort Miles because of overcrowded conditions in the Lewes Army Reserve Center. That facility was being used to over 200 per cent of normal capacity. Expanding the Lewes facility to accommodate the unit would have cost $147,000.

Four other Army reserve units use Fort Miles for weekend training. They are the 67th Transportation Platoon of Lewes, Delaware; the 315th Service and Supply Company of Dover, Delaware; Headquarters and Headquarters Company, 275th Service and Supply Battalion of Seaford, Delaware; and the 151st Transportation Platoon of Chincoteague, Virginia.

Walker

This'll Blow Your Mine

Land mines are deadly weapons. Hidden beneath the ground, they attack without warning. Most frustrating of all, after a comrade is killed, there is no way to retaliate. There is no tangible enemy, no sniper to gun down, nothing but the bleak reality that you may be next.

Much like the war itself, Viet Cong and NVA mines have no standard form or power. This means they are difficult to detect and neutralize. U.S. Army personnel have to continually develop new mine detection techniques.

Techniques, which were developed during 1969 by D Company, 1st Engineer Battalion, proved particularly effective on a 20 kilometer stretch of QL 13 north from Lai Khe, Republic of Vietnam. This area had traditionally been a hotbed of mining activity. It was a vital stretch of the military supply route and required daily opening.

Built by the French prior to World War II, the road was in poor shape. Two large trucks could barely pass on the narrow road. The pavement and much of the base had long since disappeared and had been replaced with laterite. Although civilian traffic on the road was heavy, the area of mining activity was not populated.

The initial requirement was for an accurate and

prompt mine reporting and recording system. All sweeps had been instructed to blow mines in place. A standard report format was prepared and distributed to each sweep team. Information included exact grid co-ordinates, location of the mine in meters from road center line, road width, type of firing device, how found and crater size. This aided the pinpointing of all mining activity as to type, size and location for long-range planning.

Keeping the same people on the same stretch of road was preferred. It was necessary to run the detectors on high range, and the regular alternation of sweeper and prober was important. This insured familiarity with a given stretch of road; subtle indications of a mine became more noticeable. This again resulted in a better detection ratio. Detectors run on high range were more effective, but they did not account for more than 20 to 25 per cent of the mines found.

With detailed reporting figures, two significant facts appeared. First, nearly 90 per cent of the mines found were detected visually. Second, the majority of the mines were non-metallic with slapstick detonators.

Detailed reporting and analyses, along with better detection ratios, supplied other facts. Mines were inevitably set in pairs, and mine markers were frequently used. When a pattern of three mines was used, it was almost immediately recognized. This information was valuable because after one mine was discovered, knowledge of a high possibility of another mine nearby was very helpful. In some cases the first mine discovered was the second of the pair; this raised the level of alertness considerably.

Mine markers were subtle. The traditional grouping of three sometimes existed. But more often the marker consisted of a pole, board or stalk of cane placed at right angles to the traffic lane opposite the lane in which the mine was located. When someone became suspicious of the marker, his instinct was to change lanes, which brought his vehicle squarely over the mine.

To make such markers more noticeable to sweep personnel, the road was carefully policed each day to clear the road of all trash. This had a double-pronged effect because innocent looking pieces of wood frequently proved to be slapsticks.

The road was also outposted by day, and an occasional ambush patrol was run by night. Although the number of mine casualties and equipment damage had been halved, it did not seem possible that even this number of mines could be missed by the sweeps.

For control purposes, a second sweep began in the middle of the afternoon. On the first mid-afternoon sweep, two mines were located. Teams were positive the mines had not been there in the morning. Conclusion: the mines were being emplanted by day.

Walker

Previously, no military traffic other than the sweep and its security moved on to the road until all sweeps were complete. However, civilian traffic proceeding north from Lai Khe and south from Quan Loi would follow the sweep down the road. This practice was stopped, and civilian traffic was held at these points until all sweeps were completed. Sweep personnel discovered that, with no military traffic on the road, persons following the sweep had emplaced mines behind the sweep with little fear of detection. Holding civilian traffic effectively reduced the number of incidents. However, it required close coordination with the National Police and local authorities. It was also unpopular and difficult to control.

Mining incidents first fell off to a low ebb; then they hit an upswing with the advent of the monsoon season. This had been expected because time and ease of emplacement were aided by the saturated condition of the soil. Mines were frequently found in puddles of water on the road and on the soft road shoulders. Again it was obvious that mines were being planted during the day.

Sweep personnel decided the mines were being emplaced while trucks were stopped, supposedly for repairs. It is commonplace practice to make on-the-road repairs, so the action aroused no suspicion. Signs were set up along the road warning civilian traffic not to stop; military police enforced the rule with good success. Again mining incidents fell off.

There were various other observations. There is a direct link between vegetation control and nighttime emplacement. Low roadside brush and grass encourage mine emplacement because they provide concealment. Cutting or burning this vegetation back about 20 feet greatly reduces the danger.

Periodic road blocks and detailed search of vehicles, coupled with the no stopping rule, were very effective in preventing daytime emplacement.

Examination of the slapstick revealed that the metal contacts used were often coated with heavy asphaltum. This allowed light civilian vehicles and sometimes quarter tons to pass over them without detonating. In some cases, repeated passes were required to rub through the asphaltum.

Ultimately, a detection rate of 95 per cent was achieved. These experiments in mine detection showed that there is much more to counter-mine measures than simply having a sweep team move smartly down the road.

After completing Officer Candidate School, Captain Anson F. Thorp was commissioned into the Corps of Engineers. His first assignment took him to the 538th Engineer Battalion, USARPAC, Vietnam, where he gathered the data for his article. CPT Thorp was later reassigned to the 91st Engineer Battalion, Fort Belvoir. He wrote this article as part of the third Engineer Officer Advanced Course of 1970.

YESTERDAY

a nostalgic journey into the past

Throughout its 100 year history, the Corps of Engineers Museum has stood backstage as other engineer divisions took their bows. Finally the days of understudy are over. The museum has taken the long-awaited cue and advanced to center stage.

In late April, the museum came into the spotlight it deserves. The museum—and the museum only—is now located in Building 1000 at Fort Belvoir, Virginia, home of the U.S. Army Engineers.

For 18 years, prior to the recent opening, most of the museum's 15,000 items were stuffed in one room on the second floor of the Corps of Engineers Library on Fort Belvoir. Some items were wedged among library volumes.

"The scheme was then to show exhibits throughout the library," explained Edward B. Russell, Director and Curator of the Corps of Engineers Museum. The museum and library were physically sharing a building and were organizationally combined.

Russell began the struggle for a separate museum in 1957.

"I developed plans to consolidate the museum separate from the library," Russell said. In 1970 his plan received the backing of Brigadier General Ira A. Hunt Jr., assistant commandant of the U.S. Army Engineer School.

After campaigning for the change and waiting for an appropriate vacant building, Russell made his request to Major General Robert R. Ploger, Commanding General of the U.S. Army Engineer Center and Fort Belvoir. An hour after Russell submitted his request, he received MG Ploger's affirmative response.

Located on Belvoir Road, the post's main street, it now has plentiful parking space and more floor space. The museum is now expanded and in a strategic position near virtually all of Fort Belvoir's major facilities.

Less than a mile off U.S. Highway 1, the museum is easily accessible to tourists visiting Mount Vernon, home of George Washington. Fort Belvoir is only two miles from the historic home.

"We hope to get a lot of visitor attraction," Russell said. He expects people of all walks of life to see the museum exhibits.

When the museum was part of the library, there were approximately 6,000 guided tours and 10,000 visitors per year.

Now that the museum is in its new location, Russell anticipates 50,000 visitors per year. He expects this figure to increase annually as the museum gains exhibits and renown. As before, the museum is open to the general public and free of charge.

The museum's new home is a one story brick structure which formerly housed Fort Belvoir's Data Processing Center.

The architecture remains basically colonial; this is in keeping with the Fort Belvoir and Northern Virginia style.

Remodeling will be completed in phases with both the interior and exterior of the building undergoing major alterations.

Students in the Engineer Officer Basic Course suggested plans for improving the building. Some of these concepts have been used already; others will be implemented in later phases of museum construction.

The museum decor conveys a strong feeling of the Army engineer through various textural materials. Wood, brick and shingles emphasize a rustic rather than smooth, clinical atmosphere.

"Each window becomes a part of history," Russell said. He was referring to the grill work on museum windows. Each window will be enclosed in grill work once used at West Point.

The museum is organized so there is a chronological progression through history. The first room concentrates on the American Revolution; remaining rooms progress through the Corps of Engineers' history.

The Hall of Fame Room is devoted to engineering personalities. It honors men either for outstanding civil work achievements or military leadership.

Probably the most valuable items in the museum are original maps of the seizure of Yorktown, the 1781 battle ending the American Revolution. Removed from the archives in Paris, the maps were donated by General Pinson, Chief of Engineers of the French Army in 1955.

A collection of Americana was donated by Major Victor V. Martin. It features original advice from an 81 year old Thomas Jefferson written to a youth named after Jefferson. Additional advice was added to the letter nine years later by Andrew Jackson.

The collection also has writings by George Washington, William Henry Harrison, Zachary Taylor, Abraham Lincoln and Francis Scott Key. "And," Russell added, "what collection is complete without writings from John Hancock?"

Walker

"Dear Baldie" begins one original letter from General Douglas A. MacArthur. Written in 1931, the letter related General MacArthur's thoughts upon being appointed Chief of Staff of the Army. The letter was written to Major General Julian L. Schley, Chief of Engineers and a classmate of GEN MacArthur while at the United States Military Academy in 1903. The salutation refers to MG Schley's nickname while at West Point.

The collection of Corps of Engineer castles dates from 1840 to the present. An original drawing of the castle device illustrates its initial use by the military. Numerous engineer battalion distinctions include crests and insignias.

A large variety of engineer officer and enlisted uniforms and accessories is displayed. This includes belts, hats and swords. One rapier dates back to 1840 or 1850; the first use of the engineer castle was on the handle of this rapier.

The same rapier appears in one of the museum's prized portraits. The original portrait of Brigadier General Daniel P. Woodbury, pictured as an engineer lieutenant, shows him with the light rapier. BG Woodbury, who was killed near the end of the Civil War, served as the Chief of Engineers from 1836 to 1864. The portrait was donated by his granddaughter.

Another original portrait is of Major General William M. Black, Chief of Engineers during World War II. The portrait was painted by MG Black's son.

Taken by Brigadier General Henry Larcom Abbot's personal photographer during the Civil War, a number of rare stereopticon photographs picture many of the general's personal friends and comrades in arms.

Other photos spotlight General Robert E. Lee, General Douglas A. MacArthur, a ceremony honoring Major General George W. Goethals, salvage operations of the battleship Maine and construction of the Panama Canal.

The Corps of Engineers conducted the 1910 salvage operations and 1912 final burial at sea of the Maine. For its assistance, the Corps was given the original wheel from the ship. The wheel and numerous photographs note this accomplishment.

More artifacts commemorating the construction of the Panama Canal refer to the Order of the Striped Tiger for military civil works achievement.

Exhibits spotlight various civil works projects in the nation's capital that were completed by the Corps of Engineers. Among these projects are Washington Monument, the Pentagon and the Library of Congress. Models, dioramas and graphics illustrate the construction.

Used from 1869 through World War II, a complete set of models of the Bridge Equipage of the U.S. Army is on display.

A collection of engineer and Army officer instruction manuals review officer instruction of the American Revolution, the War of 1812, the Civil War and the Mexican War.

A ship's bell is dominantly displayed. Forged in Belfast, Ireland in 1892, the bell tolled for 50 years aboard two United States vessels. It first was used on the transport Grant from 1898 to 1902 and then the dredge Chinook from 1903 until it was decommissioned in 1946.

A cannon that stood in front of the Corps of Engineers Library moved with the museum. The 1841 bronze cannon was originally removed from Willets Point, New York, the first home of the Army Engineers. The bronze six pounder stands in front of the new museum. "We consider it one of our prized possessions," Russell commented.

The collection of American and British firearms includes a derringer like the one used by John Wilkes Booth when he assassinated President Lincoln. There is an 1839 Hall breech-loading rifle in the museum's collection. One rifle was used by Mosby's Raiders in the Civil War defense of Fairfax. Another item in the collection is a Sharps breech-loading percussion carbine used in the 1876 Battle of the Little Big Horn. Russell often tells viewers that this rifle "could be the one" that killed Custer.

The most recent acquisition to the rifle collection is a chrome plated SKS; it is among the collection of basic weapons used by the Viet Cong.

Fort Belvoir's entire history will be traced from its beginning as Belvoir Plantation. As a military installation, Fort Belvoir will be covered as it changed from Camp A. A. Humphreys to Fort Humphreys and finally to Fort Belvoir.

An 1851 Austrian cavalry saber is one of the foreign gifts displayed in the museum. Presented to former Chiefs of the Corps of Engineers, Commandants and Assistant Commandants of the Engineer School, other gifts include statuettes, military dolls, figurines and silver items.

The museum's oldest holding is a gold ring dating back to 300 B.C. The Greek ring bears the likeness of Lysimachus, an engineer general who worked for Alexander the Great.

Asked which museum piece he likes best, the dedicated curator responded, "I like 'em all. You don't stay 18 years with one museum without putting a lot of heart into it," Russell added. A dedicated man who has spent countless hours searching for new items and researching the ones he has obtained, Russell said he is interested in "anything that has to do with military engineering."

He has been seeking early officer uniforms for some time; the museum's collection is weak in pre-Civil War uniforms.

Three-dimensional equipment used by engineers is also rare. Russell would like a larger assortment of items such as early surveying instruments, picks and shovels.

Because engineering projects of the corps are difficult to picture interestingly, Russell is constantly on the lookout for suitable paintings, photographs and drawings.

The museum makes no purchases. All items are gained through contributions. A sundry fund has been established to handle donations. Items are welcomed from organizations as well as individuals. Russell continually seeks additional items to enrich the Corps of Engineers Museum.

Walker

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Staff writer Rodger A. Streitmatter came to THE ENGINEER from Fort Belvoir's post newspaper, THE CASTLE. He was graduated from Southern Illinois University with a degree in journalism.

LOC

Whitehead

Vietnamization. It wasn't even a word a few years ago. But today Vietnamization spells out the top priority mission of U.S. Army Engineers in Vietnam.

The Lines of Communication (LOC) Restoration Program exemplifies the importance of Vietnamization to U.S. Army engineers. This program is the largest military engineering project ever undertaken in a foreign country. It combines the efforts of U.S. Army Engineers, Navy Seabees, civilian contractors and, of course, their Viet-

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Whitehead

namese counterparts. U.S. Engineers have taught their skills to ARVN engineers.

When this half billion dollar program is completed, it will provide the country with over 2,500 miles of modern highways. In addition to the highway network, the project will improve 770 miles of railroad and several airfields. Together these improvements will link the major population centers of the Republic.

An effective and dependable road network will tie together the rural and urban aspects of Vietnam's economy. Improved roads increase the potential for industrial growth of the basically agricultural economy. Raw material can be transported from entry points to industrial sites throughout the country. This insures that the farmer can transport his products to the urban market. The roads mean urban buying power for rural producers' goods.

LOC construction also enables the Vietnamese to resettle their homes. As each segment of the network is completed, former inhabitants return from exile to resume life at the point where enemy activity disrupted them.

After refugees are resettled, the network of bridges and byways become more important. Quick access to rice mills, markets and storage areas stimulates the farmer's interest in money crop production. The days when the peasant farmer grows only enough crops for his family's needs are over.

As it provides a transportation network, the LOC program adds security to the areas it touches. Villagers no longer have the fear that accompanies a long, seldom-used dirt path.

Another improvement in Vietnam life due to former inhabitants returning on LOC roads is resumption of formal education and medical care. Long An hamlet, near Ninh Phouc, typifies this change. When Long An's schoolmaster returned to his home, he rebuilt his house, reopened the village school and started plans for the community's first medical facility.

In another village, near the Mid-Delta city of Can Tho, a three-mile span of road provided the only link with the outside world. The 1968 Tet offensive destroyed this road and its three bridges. During the next two years, crops were moved to market by a tedious process of alternately rowing and dragging a sampan for miles. The original population of 2,100 had filtered down to a stubborn handful by April, 1970 when the damage was repaired. Traffic over the new road returned residents, trade and a sound future to the village.

Before a single foot of asphalt could be laid on Vietnam ground, tremendous effort was expended to develop the resources and capabilities necessary for road building. To appreciate the scope of the LOC program, this preliminary work must be noted.

When U.S. Army Engineers arrived in Vietnam in late 1965, only a few rock quarries were in operation, and rock was critically needed for construction of base camps and tactical roads. There are now 13 U.S. Army rock quarries and eight contractor quarries. More than 90,000 tons of rock are produced each month at the Vung Tau Quarry operated by the 94th Engineer Detachment.

In 1967, rock resources were virtually non-existent in the Delta area. So the Delta Rock Program was developed to provide large volumes of rock. During 1970, more than 190,000 tons of rock per month were moved by barge to off-loading sites throughout the Delta from quarries at Vung Tau, Thu Duc, Nui Sam and Nui Sap.

Asphalt plants that prepare surfacing material are located with crusher operations at most of the quarries. Of the 10 Army asphalt plants scattered throughout the Republic, all but three operate in conjunction with quarries. The remaining asphalt plants are located at sites near paving operations. Rock is trucked from quarry sites and stockpiled to be used as needed. In some areas, the recently improved railroad system transports rock. Rail haul decreases wear on vehicles and increases the volume of rock that can be transported.

Other preliminary work arose because of Vietnam's unusual weather conditions and wide variations in terrain and climate. These conditions spurred the development of new highway construction methods.

In the Delta, mud and a shortage of rock threatened to stalemate construction of roads strong enough to support heavy traffic. A process known as clay-lime stabilization was used. Clay is scraped out of rice paddies to form a roadbed several feet above the water level. A predetermined amount of lime is spread over the surface and mixed with the clay to form a concrete-hard road base. Once cured, the surface is paved with a double course of asphaltic concrete. Cement stabilization similar to clay-lime stabilization is used on portions of QL 13 in the Third Military Region.

The LOC program introduced commercial road building equipment into the U.S. Army Engineer units to supplement the TO&E. A total of 669 items were purchased using Military Construction Army funds. The equipment is used on all phases of road construction. Perhaps the two most important purchases were the 250 ton per hour rock crushers and the 12 cubic yard dump trucks; both items are filling vital needs. Other items include compac-

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tion equipment, soil stabilization plants, asphalt distributors and pavers.

Security on the new roads is an integral part of the LOC program. Areas subject to enemy activity—wherever jungle or heavy brush surrounds a highway—is cleared on both sides for a distance varying from 200 to 300 meters. After Rome Plows bulldoze the cover, it is difficult for the enemy to ambush traffic on the road. Opening fertile areas for agricultural development is a significant by-product of the land clearing operations.

A wide assortment of bridges links the gaps between the paved highway. Approximately 250 bridges measuring 11,300 meters will be built as part of the LOC program. ARVN engineers constructed the largest of the bridges; it measures 1,106 meters and is located at Tuy Hoa.

The Engineer Command is responsible for the bulk of the LOC construction. Nearly half of the command's 20,000 men are involved in some facet of the LOC project scheduled for completion in 1972.

The high number of engineer personnel involved with the LOC project is being reduced through extensive Vietnamization of all aspects of the road construction. ARVN engineers have been trained in operating quarries, producing asphalt, building bridges, constructing highways and land clearing. As their training encompasses more areas, the number of ARVN forces involved in engineer projects gradually increases.

U.S. Army Engineers have trained ARVN Engineers in their skills. In addition to military, Vietnamese civilians have been hired and trained by both U.S. Army and civilian contractors.

Because the Republic of Vietnam will be responsible for the roads, skilled personnel must be available to care and maintain them after U.S. Army personnel leave Southeast Asia. This is an important aspect of the training.

Vietnamization, as practiced by the engineers, is a continuous process. The increased emphasis on withdrawal of American troops from Vietnam has focused attention on Vietnamization of the LOC program.

The extent of Vietnamization can be seen on a 40-mile section of QL 1, east of Long Binh. This is the first all ARVN paving project. ARVN engineers comprise the paving crew, drive and maintain dump trucks carrying asphalt to the paving site and operate the asphalt plant at Gia Ray that supplies asphalt.

Implications of this first ARVN paving project are far reaching: Vietnamization is becoming more than just a term, it is becoming a practical reality.

MOVE BY

Lieutenant Junior Grade Kevin P. Gallen said "thanks" as the mail clerk handed him the manila envelope. Lt. Gallen tucked the packet under his arm as he pulled the fur-trimmed hood around his head and slipped on his gloves before he left the warm post office and faced the frigid cold around the South Pole Station.

Army Staff Sergeant Kenneth J. Woods tossed his manila envelope through the car window and on to the front seat. He then climbed into the car and headed for his barracks at Palmerston, New Zealand.

Alvin E. Pierce yanked his manila envelope from the narrow mailbox and slapped the tiny door shut. Car keys still in hand, he bounded up the stairs to his fourth floor apartment—one of the few in Vietnam.

Though strung across three continents, these three men are getting ready to "hit the books" in the same classroom.

The classroom: the world
The textbook: a progressive study packet
The school: US Army Engineer School (USAES)

Each week, men located around the world pick up 5,000 manila envelopes and prepare to increase their knowledge of engineering through the USAES Correspondence Course Program.

Through the courses developed at the USAES, military and civilian personnel around the world increase their knowledge and improve their skills in military engineering. Courses help mold well trained, mentally alert soldiers needed in today's technological Army. As far as practical, correspondence courses

UP MAIL!

offer instruction identical to that in USAES classrooms.

The subcourse is the actual study package the student receives. It consists of an introduction, a series of lessons with attached memorandum or textbook, lesson and examination exercises and necessary training and supplementary materials.

A correspondence course consists of related subcourses; each subcourse teaches a particular topic or phase of a subject. Individuals who do not want to enroll for an entire course may design their own study program from over 200 subcourses in the program.

Officer, non-commissioned officer and enlisted MOS career development courses, plus special functional courses, are offered.

There are four officer career development courses.

The Engineer Officer Basic Correspondence Course (E–1) is designed to increase the proficiency of engineer lieutenants in company level duties, particularly those in engineer combat units. It also provides reserve component officers the means for meeting branch qualification and educational requirements for promotion through captain. The 34 subcourses total 228 hours of instruction; they must be completed in two years or less.

Identical in subject content to the E–1 course, the Engineer Officer Basic (Nonresident/Resident) Course (4–5–C1) offers residential instruction. Students complete one or more phases of instruction by spending two weeks on active duty for training at Ft. Belvoir, Va. The course consists of a nonresident phase of 22 common subject subcourses totaling 65 hours of instruction and three phases that may be completed through nonresident or resident instruction. This course must be completed within two years.

The third officer course is the Engineer Officer Advanced Correspondence Course (E–23). It is designed to offer engineer officers a working knowledge of approved command and staff techniques and doctrinal concepts for the training and operational employment of engineer units. Completion of this course satisfies military educational requirements for promotion of reserve component officers through the grade of lieutenant colonel. Completion of 50 per cent of the course meets educational requirements for promotion from captain to major. The 71 subcourses totaling 473 credit hours of instruction must be completed within four years.

In subject content, the Engineer Officer Advanced (Nonresident/Resident) Course (4–5–C23) is identical to the E–23 course. A combination of seven phases of nonresident and resident instruction comprise the course. Three nonresident phases consist of 47 common subject subcourses and add up to 151 hours of instruction. Students complete one or more of the four nonresident/resident phases by attending two week active duty for training periods at Ft. Belvoir. The C–23 course permits students to transfer to the E–24 or USAR School Engineer Officer Advanced Course without loss of time or credit.

Two courses are designed specifically for non-commissioned officers.

The Engineer Non-Commissioned Officer Basic Career Development Correspondence Course instructs selected engineer enlisted personnel in engineer tactics and techniques for duty assignments in managerial or advisory positions. Consisting of four phases, the course totals 239 hours.

Enhancing managerial abilities is the goal of the Engineer Non-Commissioned Officer Advanced Career Development Correspondence Course. It prepares senior engineer non-commissioned officers for the US Army Command and General Staff College Special Correspondence Course for sergeant majors and operations sergeants. The course's two phases total 164 hours of instruction.

At present there are six enlisted/NCO MOS career development courses. They are used to supplement on-the-job-training, prepare for MOS tests, increase MOS proficiency or prepare for promotion. These courses also meet the needs of federal employees assigned to engineering organizations. Also, servicemen who see their future in the booming construction industry can acquire requisite job knowledge and skills that enable him to compete in the skilled labor market. Courses currently available are Combat Engineering (12B20), Combat Construction Foreman (12B40), Carpentry (51B), Plumbing (51K), Masonry (51D) and Electricity (51R).

Additional courses now in planning stages are Refrigeration and Air Conditioning, Construction Surveying, Topographic Surveying, Illustrating, Engineer Equipment Repair, Crawler Tractor Operating, Crane and Shovel Operating, Fire Fighting, Working with Sheet Metal and other skill areas.

In addition to these career development courses, the USAES offers six functional correspondence courses. They involve both military requirements and professional advancement. These courses are Engineer Officer Advanced Management, Engineer Construction, Engineer Combat Support, Engineer Technical Orientation, Engineer-in-Training and Professional Engineer Preparatory Courses.

Participation in the correspondence course is voluntary. To ensure that no interested person is denied the chance for self-development, eligible applicants receive course materials free of charge.

USAES correspondence courses are open to members of all the Armed Services—Navy, Marine Corps, Air Force, Coast Guard and Army. Civilian employees of the federal government are also eligible if the instruction is job-related. Army ROTC students, certain US citizens living in foreign countries and others authorized by the Commanding General of the US Continental Army Command may also enroll.

Information on eligibility and prerequisites for all courses may be obtained by writing the Commandant, USAES, Attention: Department of Nonresident Instruction, Ft. Belvoir, Va. 22060.

Prospective students should fill out and submit DA Form 145, Army Correspondence Course Enrollment Application. For military personnel, the proper channel is their commanding officer; civilian personnel should apply through their immediate supervisor.

Students set the pace of study commensurate with their ability to learn. After all lessons and the examination have been submitted, a certificate is issued for each subcourse completed successfully. A diploma is awarded upon completion of a career development or special course.

The USAES does not offer purely academic courses. Uniformed members of the Armed Services who desire to study a language, history or philosophy, for example, will be assisted by the U.S. Armed Forces Institute.

Students formerly enrolled in the Professional Engineer Preparatory Correspondence Course have lauded it as "exceptionally well prepared and the necessary review needed to pass my professional engineering examination ten years after my college training," "a good review for one 30 years out of school" and "well engineered, smoothly administered and have excellent coverage of subject."

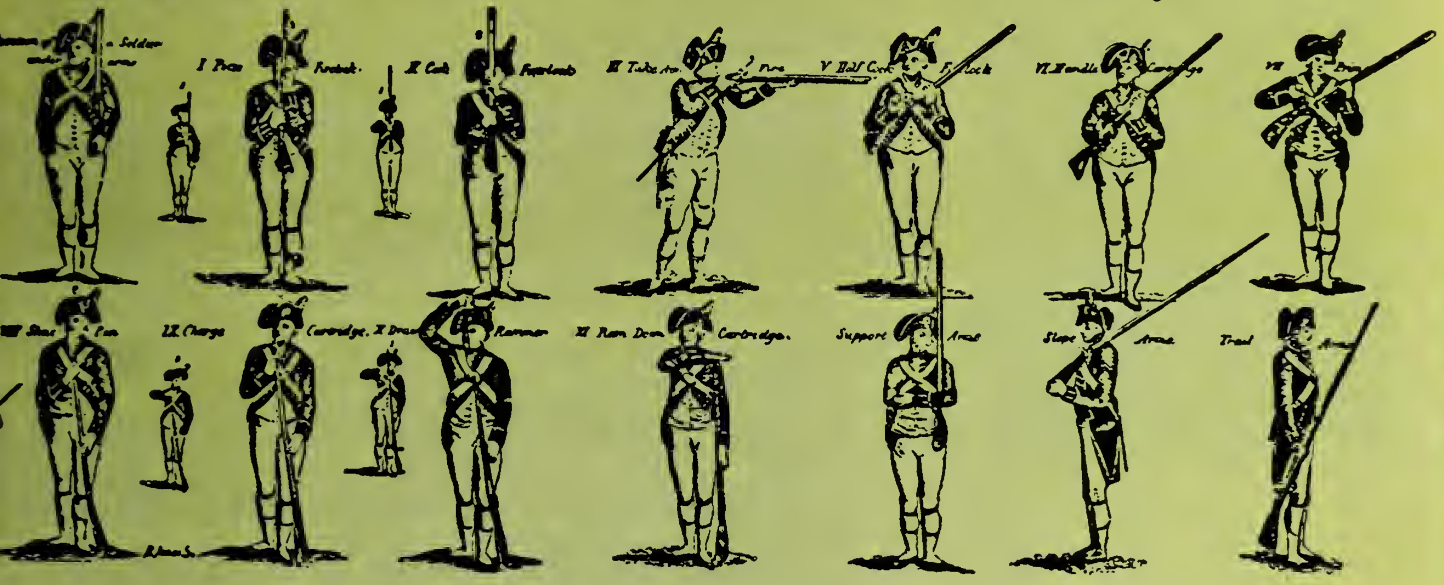
This is what the USAES Correspondence Course Program meant to many who have taken advantage of it and will mean to some 14,000 students now enrolled. Make that total 14,001.

Director of Nonresident Instruction at the U.S. Army Engineer School, Lieutenant Colonel Arthur Daoulas is from Dracut, Massachusetts. He received a civil engineering degree from the Missouri School of Mines, Rolla, Missouri and a Masters of Business Administration from the University of Maryland. LTC Daoulas commanded the 864th Construction Battalion, the Peacemaker Battalion, in Vietnam. He was also Director of Facilities, Engineering, at Fort Leavenworth, Kansas.

TO ALL BRAVE, HEALTHY, ABLE BODIED, AND WELL DISPOSED YOUNG MEN,

IN THIS NEIGHBOURHOOD, WHO HAVE ANY INCLINATION TO JOIN THE TROOPS,

TAKE NOTICE,



WE SHALL ENDEAVOR TO ANSWER THE QUESTION:

WHY ME?

In every officer's career there arrives a day of decision concerning his future in the Army. A decision to remain in the Army or to get out and sample the greener pastures seen on the civilian side of the fence is not one to be taken lightly or to be made in haste. The Army is not the right career for every man any more than every man would be a career asset to the Army. A decision to stay in the Army or get out is one that ultimately will affect every facet of the remainder of your life and that of your family. With that profound thought, let's look at some of the reasons that influence officers in their decision concerning a career in the Corps of Engineers.

The military career in general provides officers with a deep-rooted sense of satisfaction in the knowledge that they are devoting their career to the service of their nation and fellow man. Although patriotism may not be sung out as the primary reason most officers stay in the service, it is, without a doubt, one of the important intangibles that influence officers toward a military career.

The cornerstone to any personally satisfying career is the job satisfaction to be gained from the work. A glamorous, well-paying job is not necessarily a good job unless it provides the challenges, responsibility and rewards essential to the personal satisfaction of the worker.

By the very nature of our mission, the Corps of Engineers has a great advantage over other branches of the Army in providing job satisfaction for our officers. In our engineering efforts we have a lasting, physical monument to our efforts and skills after we complete a job. Whether this be a peneprime chopper pad, a section of asphalt road or a civil works dam, we can look back with pride and see a tangible result of our work. The sense of achievement in the creation of worthwhile works is the most satisfying part of engineering. The responsibility of successfully meeting a challenge through the effort and skill of yourself and those whom you command marks the Corps officer as a leader and manager of no small ability.

Responsible, challenging jobs are abundant in the Corps. Think about the men and equipment that are the responsibility of our platoon leaders and company commanders. The construction and combat support missions performed by our units will task the keenest and most imaginative of minds and make great demands on the technical and professional engineering skills of our officers. Our jobs are characteristically constructive in nature and not of the repetitive or make work type.

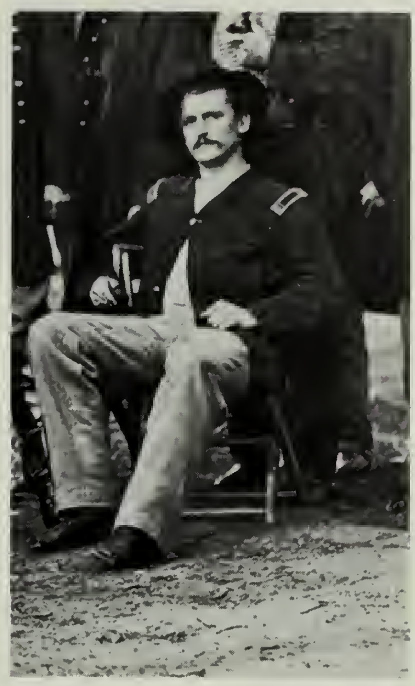
The varied responsibilities of the Corps of Engineers provide opportunities to work and develop skills in a field interesting and challenging to the individual preference of nearly every officer. An officer who wants to be a gung-ho combat leader of men can find the job he wants in the Corps just as can the officer whose interests are in the scientific research and development areas. The Corps has officers participating in all of the Army specialist programs from aviation to foreign area specialist. For the officer who doesn't want to specialize, the diversity of our work means that there needn't be a stereotyped career in one narrow field unless, of course, an officer truly desires to specialize within the Corps.

Only after an officer has assured himself that he can obtain personal job satisfaction from a career in the Corps should he consider the long list of other benefits of a military career. Certainly one of the most attractive prospects is the opportunity for advanced schooling. Recent experience indicates that about 60% of all Corps career officers can expect to obtain an advanced civil schooling degree. There are four programs available for civil schooling. They are the Degree Completion Program (Bootstrap), the officer Undergraduate Degree Program, the Advanced Civil Schooling Program and the new Advanced Degree Program for ROTC Duty. These are flexible programs that combined can satisfy a schooling desire for almost any officer that is demonstrating good performance in his duties.

The Army way of life with attendant feeling of camaraderie with your peers, the social life and family involvement, the variety of duty stations both stateside and overseas and the traditions and customs of the service gives a sense of belonging and identity that is difficult or impossible to find outside military life. Retirement, PX, commissary, insurance and medical care benefits are well publicized, recognized incentives of military service. There are other benefits not so apparent. Find out how much insurance you would need to have in order to provide the same protection that the Army survivor benefits give your dependents or to provide the income protection that you enjoy in the Army should you become sick or disabled. It is very substantial.

The most frequently mentioned reasons that Corps officers give for leaving the service are:

1. The desire for more authority
2. More opportunities for independent action
3. Freedom from red tape
4. The desire for less supervision over their work
5. Opportunities for more money
6. The belief that the officer was under utilized by the Army in relation to his abilities.

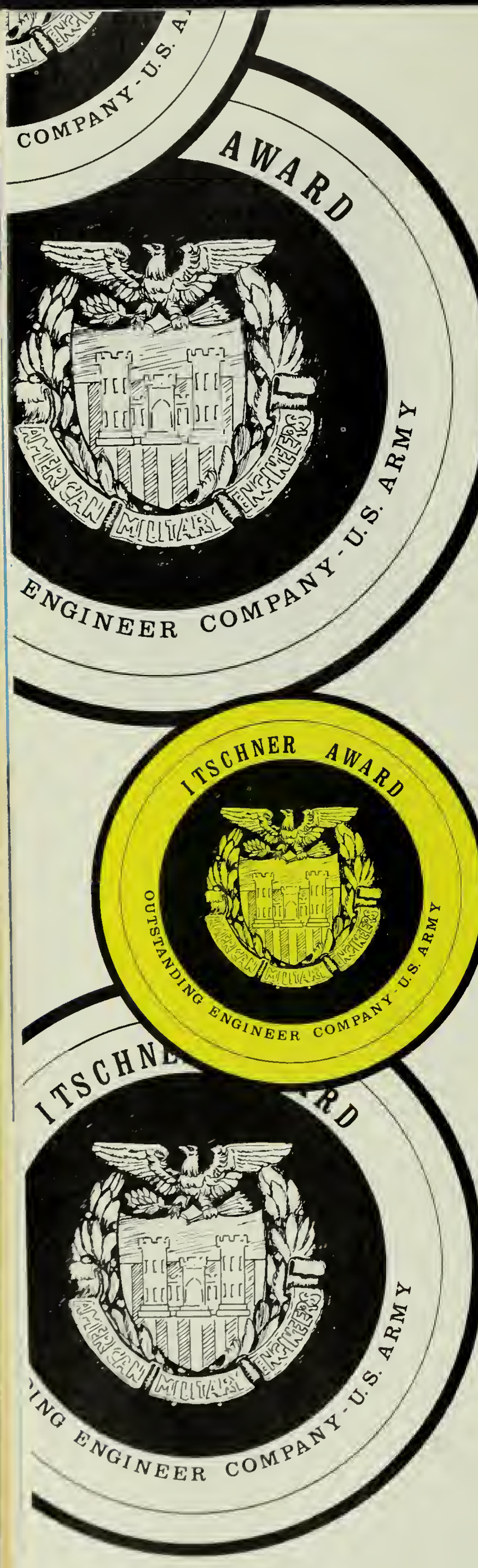


Any decision that will affect a person as profoundly as deciding whether or not to make the Army a career should not be an emotional decision made in a fit of pique or a euphoria of well-being based on a single incident. Rather, all aspects of the entire spectrum of considerations relating to your career, both pro and con, should be explored.

When all the pros and cons of Army life have been considered, a young officer should then sit back and try to view his personal situation with as much objectivity as possible. This is also the time to decide on the type of civilian work on the outside that looks most attractive and then whether or not your personal goals can be better achieved in that civilian job. A second look at the list of reasons officers give for leaving the Corps will show that these are the very same problems that your civilian contemporaries are experiencing in their work in private industry. In fact, many Engineer officers who have resigned from the Army state that the amount of responsibility and opportunity for independent action that they were allowed in the Corps was far greater than that they were afforded as civilians. This is really not unexpected because showing a profit must be the primary objective of private industry whereas that of the Corps is the training of engineer leaders and managers. The civilian world also has its bureaucratic inefficiencies and its share of poor leaders just as the Army does.

Many people work a lifetime and never are able to find a job that satisfies them personally. I feel that Corps of Engineers officers have an unequaled opportunity to find that job satisfaction in their work and in their service to our nation. This is the key to a future in the Corps and in finding a true sense of accomplishment and meaning in your career.

A graduate of the U.S. Military Academy, Major Gary D. Beech was commissioned into the Corps of Engineers. His first assignment took Major Beech to the 307th Engineer Battalion, Fort Bragg, North Carolina; he served as a company platoon leader and executive officer. After attending Flight School, he became a fixed wing aviator and flight commander for the 39th Engineer Group, Europe. Joining the 4th Cavalry, USARPAC, Vietnam, Major Beech served as rotary wing aviator and aerolift platoon leader. He then became Aviation Staff Officer of the Engineer Division, Mediterranean. Major Beech is now Assistant for Military Affairs, Public Affairs Office, Office of Chief of Engineers.


ITSCHNER AWARD
AMERICAN MILITARY ENGINEERS
OUTSTANDING ENGINEER COMPANY · U.S. ARMY

ITSCHNER

The Itschner Award is named for the former Chief of Engineers and past president of The Society of American Military Engineers, Lieutenant General Emerson C. Itschner.

Given annually by the Society, the award is presented to the unit of the Army Corps of Engineers selected as the most outstanding during the year.

This year's winner is Company C, 8th Engineer Battalion, 1st Cavalry Division (Airmobile).

Combat support of the Infantry has always been at the heart of military engineering. In that role, the Army engineer fully realizes the purpose of his efforts. Airmobile engineering, probably more than other forms, exemplifies the close bond existing between infantryman and engineer. Mission-orientation, aggressiveness and response reach a zenith in the airmobile engineer. With the Vietnam conflict drawing to a close, it is fitting that we seize this opportunity to acknowledge the unique infantryman/engineer relationship characteristic in airmobile units.

Throughout the six years that the First Team has been in Vietnam, the Skybeavers of the 8th Engineer Battalion have provided engineering acumen and backbreaking labor imperative to support of highly fluid warfare. The assault into Cambodia may well have been the most dramatic and successful operation of the war, and, of all the engineers, the Skybeavers of Company C, 8th Engineer Battalion, led the way. This company epitomizes an outstanding airmobile combat engineer unit. The company's performance during the Cambodian Campaign, as well as for the entire year, was superb. Company C contributed immeasurably to the successful completion of the 1st Cavalry's mission.

During 1970, the unit amassed an impressive record in all aspects of direct combat engineer support to the 3rd Brigade of the division. The Cambodian Campaign, during May and June, was the high point of this exciting year.

Before, during and after this operation, the company never failed to accomplish all missions superbly.

The months before the Cambodian Campaign were filled with extensive combat support. The company was primarily involved in the construction of battalion-sized fire support bases, airfield upgradings and minesweep operations.

During late spring and early summer, the pace became hectic as the Cambodian Campaign grew in intensity. Combat engineer effort that initiated, sustained and later withdrew the

AWARD

massive onslaught was of a scale never before experienced in the Vietnam War. Company C, 8th Engineer Battalion led the way.

Performing in a superb manner during the campaign, the unit contributed significantly to the history of airmobile engineer operations in the Vietnam War. No other engineer company in the III Military Region has equaled Company C's outstanding performance during this period. For every seemingly impossible obstacle placed in the unit's path, some method was always contrived to overcome it and accomplish the objective. Company C stands alone above the other support of the 1st Cavalry Division during the Cambodian Campaign.

The success of the Cambodian operation, and resultant drawdown of enemy forces, permitted greater dispersion among the tactical units in the following months. Combat engineers were able to devote more engineer effort to the improvement and construction of fire support bases. Missions included minesweeps, carpentry, sling-outs, revetment construction, demolitions and every aspect of important firebase construction. Each mission was met with enthusiasm and aggressiveness.

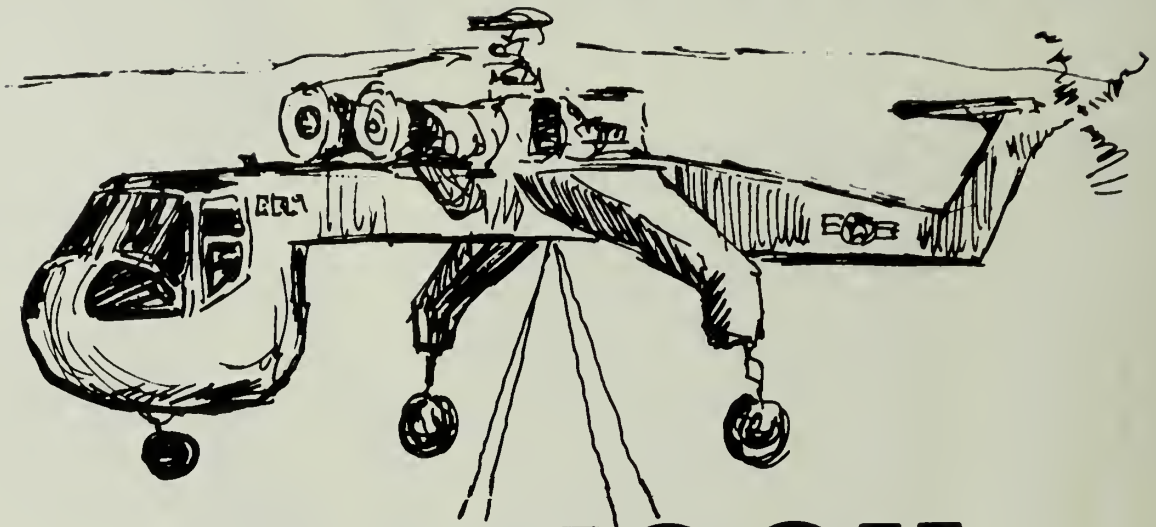
To cap an impressive year's activities, and on top of all the combat and combat support missions, the men of Company C prepared for and successfully passed the Division Annual General Inspection during December.

The year was a brief, but monumental, period in the history of a proud combat unit. From the push to BuDop, with subsequent build-up, to the historic thrust into the heart of the North Vietnam sanctuaries in Cambodia, and further, to the brigade relocations and concomitant problems in a new area of operations, the year 1970 saw an unsurpassed chronicle of success for the Skybeavers of Charlie Company, 8th Engineer Battalion.

The ability to get the job done in the intense, fluid combat environment, combined with unsurpassed espirit de corps, made the unit truly without peer and deserving of the highest recognition.

The Itschner Award Selection Committee also named two companies to receive honorable mention for their outstanding performances during calendar year 1970. These commendations went to Company A, 11th Engineer Battalion, Combat, Korea, and Company D, 79th Engineer Battalion, Construction, Europe.

ITSCHNER AWARD
OUTSTANDING ENGINEER COMPANY - U.S. ARMY
AMERICAN MILITARY ENGINEERS



SKYHOOK

the role of the helicopter in engineering

Today's technological Army is constantly on the lookout for advancements to streamline its military operations. Adequate equipment is continually being replaced as more efficient equipment is discovered. Air mobility, one of the Army's top research programs, now offers a solution to the many restrictions of surface transportation in the support of construction.

The replacement: the helicopter.

There are, for example, numerous potentials for the helicopter as a resource for bridge building, or in more generalized terms, as a resource for gap crossings. Although many characteristics peculiar to the helicopter provide advantages, there are also associated disadvantages. There is, however, evidence of a clear plus in the area of potential benefits to the construction industry.

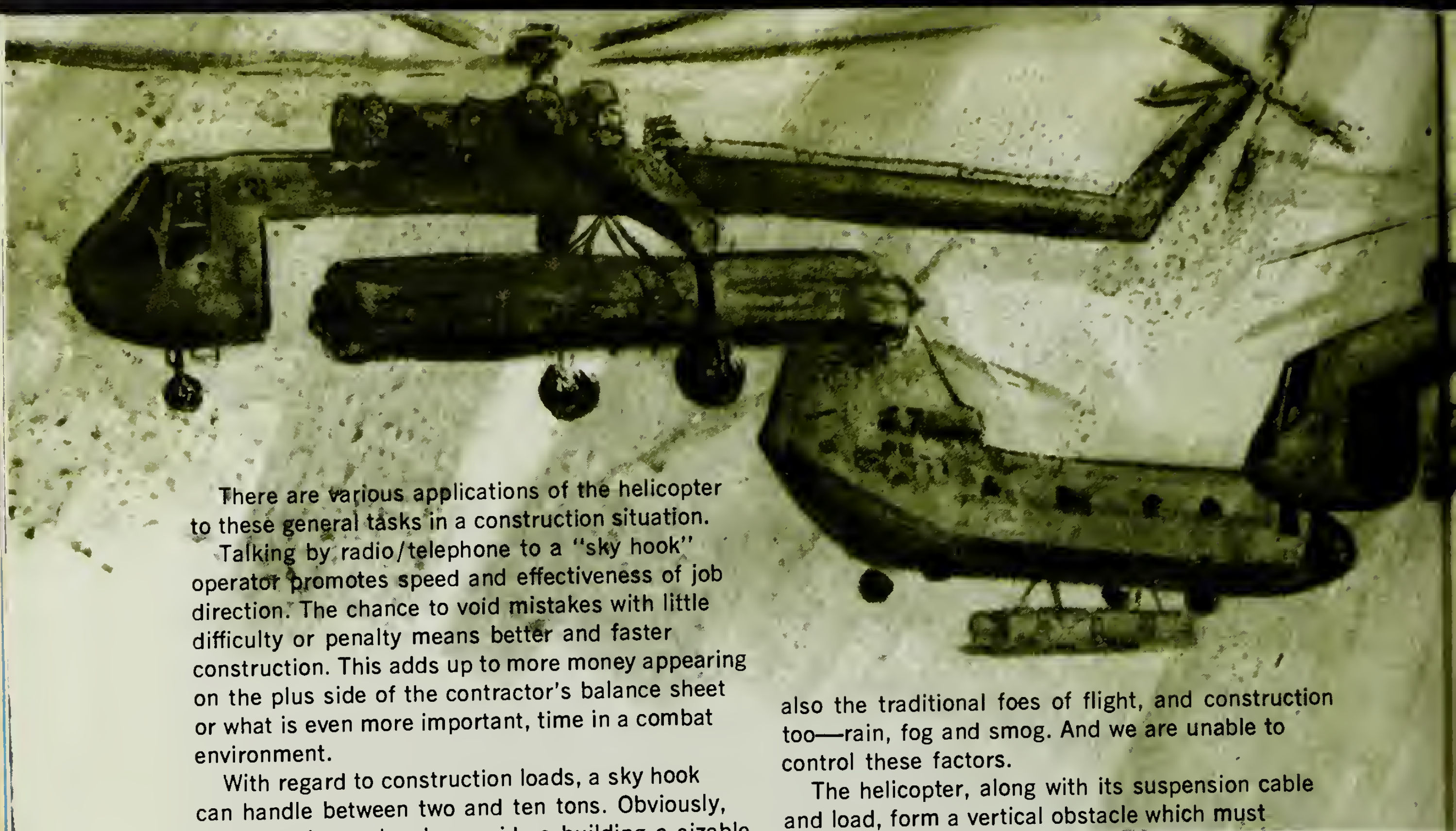
What engineer has not been faced with a problem which could have been easily solved with a "sky hook?" But, how many have ever employed the one item available to them that can be literally described as a "sky hook," the helicopter?

In the broadest construction sense, there are three basic tasks the helicopter can accomplish.

1.) The helicopter, of course, can transit areas of steepest grades, swamps, water, snow or heavy timber stands.

2.) It can comfortably cruise at speeds over 100 miles per hour without regard to the state or presence of road net or waterway.

3.) It can operate from hastily prepared locations to receive cargo in an area only slightly larger than that required for the cargo itself. Compare that to the area needed for turn around of grounded transport and for off-loading and storage. And, of course, if materials can be provided on a short-term delivery schedule, the need for large storage on-site is gone. This fact offers savings in manpower and equipment.



There are various applications of the helicopter to these general tasks in a construction situation.

Talking by radio/telephone to a "sky hook" operator promotes speed and effectiveness of job direction. The chance to void mistakes with little difficulty or penalty means better and faster construction. This adds up to more money appearing on the plus side of the contractor's balance sheet or what is even more important, time in a combat environment.

With regard to construction loads, a sky hook can handle between two and ten tons. Obviously, no one today seriously considers building a sizable bridge using a single vehicle to haul materials. When we get up in the range of ten to twenty tons of transport per helicopter load, the prospect of substantial deliveries becomes more attractive. Certainly the rate of initial progress in construction could be increased, even today, and lead to economics.

Another advantage of the helicopter is its separation from surface traffic patterns or congestion. In addition, the helicopter does not add to ground vehicle congestion at the work site. The mobility and flexibility of the helicopter in working has already been mentioned.

The helicopter also has disadvantages. It is not a "fail-safe" mode. There is always the threat of total loss of vehicle and cargo in case of a catastrophic failure of the vehicle. On the other hand, a helicopter can equal or better safety records of the cranes currently employed in the trade and is free from the hazards of lines of communication interdiction.

There is one new and significant factor the builder must consider when using the helicopter—air disturbance potential. This involves the problems of rotor-wash on personnel and materials at the job site, and the wind loading on the cargo being carried.

Most engineers readily concede that an airborne vehicle is more sensitive to weather than ground based vehicles. Helicopter operation is influenced by air density or violent air turbulence. There are also the traditional foes of flight, and construction too—rain, fog and smog. And we are unable to control these factors.

The helicopter, along with its suspension cable and load, form a vertical obstacle which must compete for air space with other aircraft, high buildings, transmission lines and radio towers.

Our sky hook also has a limit in single-mission endurance because of fuel consumption. Fuel and payload capacity offer certain tradeoffs, but continuous airborne operations must today be held below two hours.

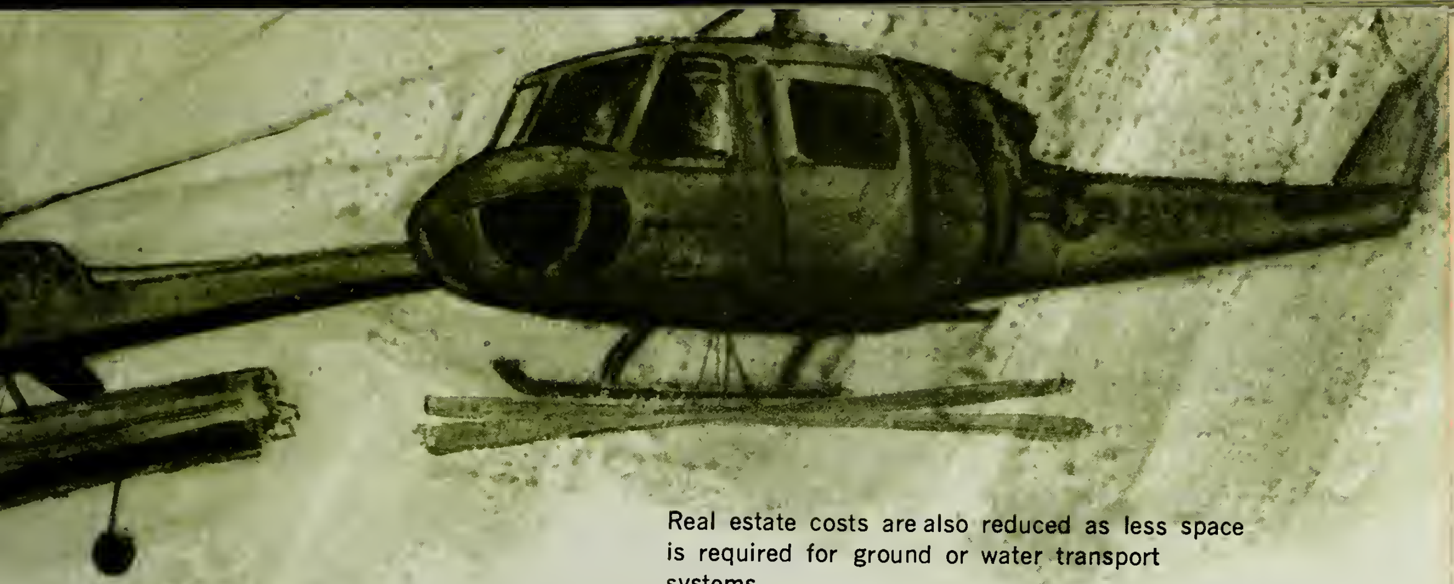
And finally, when it comes to precise placement of materials, the airborne vehicle does not provide a standing point of reference in space.

These disadvantages may seem imposing if viewed in isolation. However, they differ from conventional construction systems mainly in degree of disadvantage.

For example, there are currently various ways a bridge builder might find it advantageous to use rotorcraft. Over time these uses will expand to keep pace with the added capabilities of helicopters.

Delivery of men, materials and equipment to relatively inaccessible locations may make the chopper the only reasonable method of transport where time is an important factor in the bridge construction.

Obviously, if equipment is required on each side of a substantial gap, the use of a helicopter to move the equipment from side to side means efficient use of the machinery with associated savings.



A recent engineering magazine article explained how a builder used choppers to pour concrete for pile caps. Application of this approach may soon increase.

The full potential of eliminating scaffolding and other false work has only been touched to date. The press abounds with examples of helicopters used to emplace church steeples and towers.

A few words now about the most dreaded of details—cost of operation. A helicopter with a speed of about 100 miles per hour, an endurance rate of 2½ hours and a load capacity of 4,000 pounds can be rented for between $300 and $350. The flying crane, at a speed of 50 nautical miles per hour, can deliver 16,000 pounds for $1,500 to $2,000 per hour. When compared to the normal price for a 20 ton truck mounted crane at $20 per hour, the price tag seems large. However, when you consider the cost of auxiliary transport and crane rental at both ends, the price falls within range.

Now, let's take a look at where some of the savings to a builder would appear. The fast transport permits economic hauling over long distances; this reduces the need for multiple bases of operation. Less transportation time for highly-skilled, and therefore highly-paid, technicians results in significant payroll cuts. Real estate costs are also reduced as less space is required for ground or water transport systems.

Replacing traditional equipment such as cranes, barges, elevators and walkways with rotorcraft has not been fully studied. However, the development of self-contained pile drivers would permit multiple insertion of piling. And this, of course, offers substantial savings in time—a most important commodity. As industry improves helicopter performance, the vehicles will have ever broadening applications in bridge construction. The Corps of Engineers should lead the way.

Military engineers with foresight are looking forward with anticipation to the day when a 25 ton lift capability becomes routinely available. A civilian chopper with such capability, when coupled with greater reliance on factory fabrication of bridge components, will promote changes in methods and techniques of design, manufacture and erection of bridges.

Along with all other Army engineers, I am looking to a future of air mobility in the Engineer Corps.

It is difficult to capsulize a career as distinguished as that of Major General Robert R. Ploger. Upon graduation from the U.S. Military Academy, MG Ploger received his commission into the Corps of Engineers. He commanded the 121st Engineer Combat Battalion through the Normandy, Northern France and German campaigns. As Division Engineer he advised the commanding general for the D-Day assault on Omaha Beach, for which his unit received the Distinguished Unit Citation. For three years he was assigned to the Supreme Headquarters Allied Powers, Europe. While in Vietnam, MG Ploger commanded the 18th Engineer Battalion and the U.S. Army Engineer Command and acted as Senior Advisor to the Chief of Engineers of the Republic of Vietnam. He was then assigned to the Office of the Chief of Engineers and appointed the Director of Topography and Military Engineering. After organizing the Army Topographic Command, he served concurrently as its initial commander and Topographer of the Army. He then became Director of Military Engineering in the Office of the Chief of Engineers. In July, 1970 MG Ploger accepted his present position as Commanding General of the U.S. Army Engineer Center and Fort Belvoir. He has received master's degrees in engineering and business administration.

On behalf of the Officer Personnel Directorate, may I congratulate you on the first issue of The Engineer Magazine. I am particularly pleased that space will be made available in each issue to the Colonels Division and the Engineer Branch to assist them in keeping you informed—for an informed officer is by nature more dedicated and maintains higher professional standards.

I invite you to visit the Officer Personnel Directorate when you are in the Washington area. For those of you who cannot, write the Colonels Division or the Engineer Branch, keeping them advised as to your preferences. Let me assure you our major aim for you is a successful and satisfying career.

Sincerely,

Richard A Edwards Jr

RICHARD A. EDWARDS, JR.
Brigadier General, USA
Director of Officer Personnel

We in the Branch welcome this additional opportunity to get the word to you. Your success in your career and your overall ability to meet any requirements are the reasons for our being here. And keeping you advised is a major task in that effort.

In each issue we plan to cover those subjects we feel of greatest interest to the majority. You can help us by letting us know your thoughts, reactions, and desires. As in our newsletter, we will be brief, and direct you to source documents where necessary. If any questions remain, please write.

The opportunity to serve you is a satisfying assignment for all of us in Engineer Branch. We share pride in your individual success.

Joseph A. Jansen

JOSEPH A. JANSEN
Colonel, Corps of Engineers
Chief, Engineer Branch, OPD

We in Colonels Division join in welcoming this opportunity to get in touch with you. Through this publication, we hope to provide timely information pertaining to colonels assignments around the world.

As information must flow in both directions, we urge you to pass on your desires and future plans. This will help in our providing the best possible assignment to you.

Best wishes and continued success.

Charles J. Fiala

CHARLES J. FIALA
LTC, CE Assignment Officer
Colonels Division, OPD

BRIDGING THE GAP

Personnel Notes

Sound Advice

Basically your biggest help to a successful career remains good efficiency reports. Do your job well—do your best—and the efficiency report will take care of itself—and you. It helps you be selected for better assignments, schools and promotions. Visit the Engineer Branch at OPO when in Washington and review your files. There you can receive advice on how well you are doing, and map out potential career opportunities. If you can't visit, make sure you submit your preferences in writing. Not everyone may get his first choice, but we make every effort to come as close as we can.

Like Stability?

Increased emphasis is being placed on achieving greater stability for all officers as well as their families. The Army recently reaffirmed the policy stabilizing field grade command assignments a minimum of 18 months and company command assignments a minimum of 12 months. With short tour requirements decreasing, our goal is a minimum of two years between any PCS move with an objective of three.

Promotion Outlook Optimistic

Current average service for promotion to Colonel is 20.5 years, Lieutenant Colonel, 14.2; Major, 8.1; Captain, 2; and 1st Lieutenant, 1. The forecast for the future remains somewhat the same except that the time to make Captain will gradually increase between now and 1 July 1973 to 3.5 years. These times compare very favorably with the 1965 figures which were 22.3 years to Colonel; 17.0 years to Lieutenant Colonel; 10.8 years to Major; and 4.0 years to Captain.

Overseas Tours

The overseas tour situation is changing gradually in accordance with the decrease in short tour requirements. A considerable number of our officers still have to be separated from their families; approximately 41% of Engineer officers are currently overseas, with 26% in short tour areas. Majors and aviators of all grades have been most affected, with many having gone back to Vietnam for a second tour after 20 months, and some on a third tour. Current turnaround time to second tours is about 28 months for majors and about 48 months for captains.

Civil Education Opportunities

The Undergraduate Degree Program, the Degree Completion Program, the regular Graduate Degree Program, and the Advanced Degree Program for ROTC Instructor Duty afford a young officer a number of means to advance his engineering skills and background. In addition to the DA sponsored programs, the Engineer School has a program where an officer in the Advanced Course or on the faculty has the opportunity to work towards either his undergraduate degree or an advanced degree. Some 78% of our Engineer officers have basic degrees while 22% have advanced degrees.

essayons

Scene 1. **Office of Major General R. R. Ploger, Commanding General, United States Army Engineer Center and Fort Belvoir, on 1 December 1970. General Hunt and Major Tom King, Information Officer, are seated. General Ploger speaks:** "Jim, I think that it would be wonderful if you could get the first copy of *The Engineer* out for our Annual Dinner on 30 April. What do you think?" General Hunt: "Say, that's a great idea. We will get on it right away."

Scene 2. **General Hunt's office on 1 February 1971. Major King is speaking:** "Boy, we are running into a rocky road getting permission to use color for the engineer magazine. I sure wish you could do something. If you don't, we're dead." General Hunt: "Tom, let's check with my good friends in the Adjutant General's office and see if we can get a sympathetic hearing."

Scene 3. **General Hunt's office on 10 March 1971. Major King is talking:** "It was a lifesaver that the Adjutant General approved the use of color but we don't have a contract yet and it will take 45 days to print the magazine after we get a contract. The earliest we can get the magazine published is mid-June. On top of that we have no art supplies and we haven't rounded out our staff. I think you had better tell General Ploger that we just can't make it!" General Hunt replies: "You can tell the CG, but I am going to see if we can't get a contract."

Scene 4. **General Hunt's office on 13 March 1971. Major King is present.**
General Hunt speaks: "Well, the Government Printing Office promises that if they can't get us a contract right away they will print the magazine themselves. They state they will do everything possible to meet General Ploger's deadline. The only thing is they need final copy by 22 March."
Major King turns a silly green and says: "If the Adjutant General and the Government Printing Office can come through so can we. The art director will use his own supplies and we will work everybody until the copy is ready."

P.S. This first edition of *The Engineer* may not be its best but never has an engineer magazine been published by so few, with so little time and so little material and with so much moral support from nonengineers—Major General Verne Bowers, the Deputy Adjutant General; the Honorable A. N. Spence, the Public Printer of the United States; Major Tommy King, Infantry, the Editor; Lieutenant Joe Walker, Infantry, the Executive Editor; and Mr. John Savage, the Art Director. I want you all to know that *The Engineer* has been baptized in the true spirit of "Essayons".

BG Ira A. Hunt, Jr.

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a word

In this modern, fast paced, mod world we are all concerned with "how best to communicate or establish a meaningful dialogue with our church, organization, business, or school?"

Word of mouth, printed media, radio, TV all are extremely effective, if used to full advantage.

The Engineer School is using the medium of this magazine. Realizing that this is not a new approach and not wanting to create just another military publication, we envisioned a modern, innovative and profession-related magazine as an effective, responsive communication medium for the School. It is designed to communicate current military engineering information about new technology and developing concepts for use by the Corps worldwide.

The Engineer will serve as a forum for the exchange of ideas and points of view whether they represent the conservative, the controversial or the forward thinking. We hope that it will stimulate new ideas, the remolding of existing practices and the enhancement of new professional awareness, skills, esprit and accomplishments. Controversial areas of concern and new "free-thinking" ideas will be published, if well presented and well documented.

The Engineer is establishing the Henry Larcom Abbot Award for excellence in writing. The award will be presented to the author of the best paper written by an advanced course student. The student will receive a plaque, a letter of commendation and a monetary award. The first of such articles will appear in the Summer issue.

A prime ingredient in communications is feedback. Without this reaction the effectiveness of the magazine cannot be evaluated, or its progress charted. We seek your comments and your contributions so that we may provide you with the best possible medium of communication. Without feedback we will operate in a vacuum. A thriving, responsive publication cannot be productive under such conditions.

The Engineer is a non-technical, readable, informative publication. We are seeking articles from you—the Engineer professional, whether you be a student, a member of the staff or faculty, or with troops in the field. Rank is of no concern to us—we desire articles from enlisted and officers alike. We want items of concern, lessons learned and just good solid stories with supporting photographs.

Our goal is simple—to stimulate the thinking of the Corps! The Corps can ask no more or no less of the Engineer, except technical proficiency and professional competence. We hope The Engineer will enhance both.

MAJ Tommy B. King

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designed for
professionals

U.S. Army Engineer Scho
Fort Belvoir, Virginia

MG Robert R. Ploger
Commandant
BG Ira A. Hunt
Assistant Commandant
COL William F. Hart Jr.
Deputy Assistant Commandant
MAJ Tommy B. King
Officer-in-Charge
Robert G. McClintic
Editor
Michael J. Tercy
Associate Editor
CPT Tom Trivan
Circulation Manager
John W. Savage, Jr.
Art Director

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ABOUT THE COVER

Apollo 14 blasts off the launching pad at Cape Kennedy on another historic trip to the moon. Although no Engineer was aboard the space craft, the Corps made significant contributions to the success of the moon shot. It was the Corps that provided the maps which charted the astronauts path to the moon. It also was the Corps that supervised the construction of the Kennedy launch base.

engineer interview:

with lieutenant general Frederick J. Clarke

In fulfilling its never ending commitment to inform the Engineer Officer, **the engineer** *magazine went to the top of the Corps hierarchy to conduct a personal interview with the Army's Chief of Engineers, Lieutenant General Frederick J. Clarke.*

As Chief of Engineers, General Clarke is the project manager for Army engineering support and as such is responsible to the Secretary of the Army and the Chief of Staff for managing of a wide variety of engineering activities.

The General was appointed to the Corps highest position August 1, 1969, following a three year assignment as Deputy of Engineers in Washington, D. C.

Commissioned in the Corps of Engineers in 1937 following graduation from West Point, General Clarke's career has been one of dedication to the Corps. In World War II he served as a battalion commander overseas and was later assigned to Washington for duty with Army Service Forces. In the post war period, the General had assignments in the field of atomic energy and at the Armed Forces Special Weapons Project at Sandia Base in Albuquerque, New Mexico. As District Engineer of the Trans-East District of the Corps in the late 1950's, General Clarke was responsible for military aid construction in Pakistan and Saudi Arabia and initiated transportation surveys in East Pakistan and Burma.

The General received his masters degree in civil engineering from Cornell University in 1940. He has also attended the Armed Forces Staff College, the National War College, and the Advanced Management Program of the Graduate School of Business at Harvard University.

In the early 1960's General Clarke served as the Engineer Commissioner for the District of Columbia, and from 1963 to 1965, as Director of Military construction in the Office of the Chief of Engineers. From 1965 to 1966, he served as the Commanding General of the US Army Engineer Center and Commandant of the Engineer School at Fort Belvoir, Virginia.

In carrying out his responsibilities as the Chief of Engineers, General Clarke heads the world's largest and most versatile construction agency. As manager of the Nation's comprehensive Water Resources Development Program, the Army Civil Works Program, the Chief of Engineers directs waterways planning, design, construction management and engineering service for the Army, and as assigned; designs and constructs for the Air Force, NASA, the US Post Office, and other U.S. Government agencies as well as governments from other countries.

The Chief of Engineers and his staff are actively engaged in providing general and specialized engineering support to the Army, which includes assistance in organizing, equipping, training, and force structuring of active and reserve Engineer units; the development of new and improved engineer techniques and materials; establishment of a worldwide geodetic datum for mapping through the use of satellites; as well as special studies with logistical and engineering implications for the joint and General Staffs.

In short, it can be said with great certainty that General Clarke, the Chief of Engineers, is a man with his finger on the pulse of the Army, as well as the Corps of Engineers.

ENGR: GENERAL CLARKE, PLEASE EXPLAIN YOUR ROLE AS CHIEF ADVISOR ON ENGINEER ACTIVITIES TO THE CHIEF OF STAFF.

CLARKE: This has been spelled out in Army Regulations in what I would call pretty formal language. However, I like the description that came out in some of the supporting papers that said the Chief of Engineers in essence is the systems manager for all engineering matters in the Army. Our job in this office is to make sure that all Engineer activities in the Army are moving together. This encompasses the development of doctrine, which is primarily the responsibility of CDC (Combat Development Command), the training, which is CONARC's (Continental Army Command) responsibility, development of equipment which is AMC's (Army Material Command) responsibility, and the field operations, which are under the respective field commanders.

We accomplish this task by looking into all aspects of Engineer operations in order to decide on areas which look as if they need special attention. Once this is done we can get those who are responsible to focus their attention to specific problem areas.

My office does this in many ways. Probably the best way is by discussion. By this means we reach agreements, sometimes on an informal basis, putting accent into areas where we think we are having trouble.

ENGR: WHAT IN YOUR WORDS IS THE REAL MISSION OF THE CORPS OF ENGINEERS?

CLARKE: Condensed down to a very few words, the mission of the Corps of Engineers is to enhance the capability of the Army to live and fight in the field. This, of course, includes the myriad activities involved in the host of combat engineering and construction tasks which we perform. All of our other missions, many of which are very significant and of great importance to the Nation, serve only to enhance the capability of the Corps of Engineers to provide this engineering support to the Army.

ENGR: WHAT ARE THE MAJOR ACCOMPLISHMENTS OF THE CORPS IN VIETNAM?

CLARKE: The war there has been called an engineer war and I would agree that we have been called upon to play a very important role in Vietnam. One of the biggest jobs the engineers were called upon to perform in Vietnam was the construction between 1965 and 1969 of 26 major base cantonments each housing from 1,000 to 40,000 men. Before 1965 the only major port in South Vietnam was in Saigon. We built or improved ports at DaNang, Qui Nhon, Vung Ro Bay, Cam Ranh Bay, Saigon and Vung Tau to handle all deep draft shipping. The Lines of Communications Restoration Program, better known as the LOC Program tasked Army engineers with the upgrading and hard surfacing of about 2,700 kilometers of highway. To date nearly 2,000 kilometers of this highway have been completed. Our engineers constructed 22 hospitals with more than a 6,000 bed capacity and built more than 15 million square feet of refrigerated, closed and open storage space to support the allied effort. Army engineers there have constructed 23 major airfields that can accommodate C-130 type aircraft. Eight of these airfields can handle jet aircraft. These are in addition to numerous other support strips which were built by Army engineers. Engineer efforts in Vietnam have been monumental and I think that we all can be proud of the accomplishments of the Corps in that country.

As in any large undertaking, we learned a great deal during our operations in Vietnam. As we learned and were faced with new conditions and requirements, we developed and introduced new equipment and concepts. During times of rapid buildup and deployment, there is always a tendency to reinvent the wheel. I believe we avoided that in Vietnam. One major innovation in Vietnam was the use of land clearing on a large scale with specialized equipment. Our Rome Plows have cleared over 700,000 acres of land. This has denied concealment and refuge to the enemy, improved security and opened land for agricultural development by Vietnamese farmers. In order to do the large scale construction our battalions are engaged in with the LOC program, we purchased large commercial type construction equipment to augment our units' TOE equipment.

The commercial equipment increased production significantly and has worked so well that we are giving serious consideration to including certain items of off-the-shelf civilian construction equipment in the TOE of all our engineer units. Road construction in the Delta posed many problems due to the lack o aggregate in that area. Refinements in soil stabilization methods using lime-clay mixture largely solved this problem fo us. With the advent of large scal use of helicopters in Vietnam, th control of dust became a majo problem. The introduction of dust palliatives, chiefly peneprime, proved to be the answer to this particular problem.

We developed and introduced many new pieces of equipment in Vietnam to include: a light tactical aluminum bridge mounted on armored personnel carriers for rapid crossing of short gaps; sectionalized airmobile engineer equipment that could be transported by helicopter; a new lightweight, heavy-duty aluminum runway matting; pre-engineered and prefabricated DeLong Piers that were used to develop ports; and T-17 plastic membrane for airship and helipad surfacing. Of course this is just a partial listing, but I think that it is representaive and can give you some idea of the magnitude of our work and development efforts in support of our role in Vietnam.

The major problem we have had in the past, and are still coninuing to have, is trying to decide what areas really need the most attention. We have approached this problem in a vaiety of ways. The staff and I have been able to sense the most pertinent problem areas through our field visits. Through the visits we get reactions from people in he field and gain an insight into what areas need more attention nd what should be done to make orrections. This method is probbly the best in dealing with this roblem.

We have within our military ngineering directorate here, a roup of people who are constantly analyzing all of the funcons of the Army Engineers and valuating on a subjective basis what areas need more activity. Additionally, we receive field reorts that come in from such areas as mine and countermine warfare where there is a definite need for more activity. These are just some of the ways in which we determine where the force of the office should be directed.

ENGR: HYPOTHETICALLY, IF THE VIETNAM CONFLICT ENDED TOMORROW, WHAT WORTHWHILE TRAINING WOULD THE CORPS HAVE TO OFFER THE RETURNING ENGINEER OFFICER?

CLARKE: I think we are making some very definite progress in stateside training. The Army has wholeheartedly adopted the concept that our Engineer units that are in training will be used to meet general construction requirements at various posts, camps, and stations. However, I want to stress that these units would not be performing construction in competition with industry on projects approved by Congress in the Military Construction Army appropriation.

We are also in the process of setting up utility detachments which will perform basically the same function as conventional construction units. These detachments will be engaged in minor construction, and aid post Engineers in the States.

On the other hand, many Engineer units presently stationed in Europe have very heavy construction commitments which they carry out for the Air Force. These are often in addition to their "normal" commitments for the Army.

Similarly, as Vietnam draws down, we are going back to the posture that we had before the Southeast Asia conflict of assigning many more officers to our Engineer Districts. We are authorized to put 600 officers into this program and we are now utilizing about 400 of this number, many of which are lieutenants on the "Volunteer Indefinite Program." Of course, they are going to be disappearing soon and their places will be taken by captains and majors. I would anticipate that we are talking about two to three hundred additional captains and majors going into District assignments in both Civil Works and Military Engineering.

We also still have troops in many overseas locations such as Alaska, Hawaii and Panama. Also we have our Mediterranean Division, which is presently engaged in Saudi Arabia. Programs of these types will most certainly be continued. Likewise, we still have the Reserve assignments and ROTC instructors program and I am sure we will assign more officers in these areas in the future than we are currently.

This brings me to the point that I have been stressing. As the strength of the Regular Army goes down, we have got to make an all out effort to get the Reserves and National Guard up to the level to assume a readiness posture to back up the Regular Army.

ENGR: WHAT IS PRESENTLY BEING DONE TO REACH THIS

LEVEL OF READINESS TO WHICH YOU REFERRED?

CLARKE: Many things, such as assigning more and better qualified officers to Reserve and National Guard units, increasing equipment priorities and developing more realistic summer training programs.

The Army is also considering the "Sister Unit" approach, which I think is a good idea. Within this concept, a Reserve unit is allied with a unit in the Regular Army for training and administrative purposes. Some concepts would even make reserve battalions or brigades a formal part of a Regular Army unit. The only difference will be that the unit will not be on active duty.

I think this will bring up the esprit and morale of the Reserve and National Guard units, and will enable the Army to utilize all Engineer units to their fullest potential .

ENGR: WHAT IS BEING DONE TO IMPROVE THE MILITARY ABILITY OF THE CORPS?

CLARKE: We are continually trying to improve the equipment and materials that our engineer soldiers work with in the field. We are well along in the development of new and improved floating and fixed bridges that will materially improve our bridging capabilities. A great deal of effort is going into mine and countermine warfare. Our research and development work had produced some very promising new concepts in this area that we hope will solve some of our present short-comings. We have studied new organizations for the construction and combat battalions and will be field testing a new functionally-organized construction battalion Table of Organization and Equipment (TOE) next year. New and improved engineering design and rapid construction criteria for combat support facilities are being developed that are responsive to the needs of modern, highly mobile warfare. We are upgrading the instruction and training of our engineer soldiers and officers. In capsule form, we are attempting to train and organize our engineers to obtain the maximum results from the best equipment in the world.

ENGR: WHAT MILITARY PERSONNEL SHORTAGES IS THE CORPS CURRENTLY FACING?

CLARKE: At this time, and for the immediate future, the only officer shortage of real concern occurs in the grade of major, where only slightly more than 50 percent of the authorized strength is available. Strengths of other commissioned grades are in relative balance. The major's situation should improve as future promotion boards meet and the Army approaches its lowered strength objectives. And we also have retention of our junior officers to help meet our needs. I have been very much impressed by many of our new junior officers in recent years. They are highly qualified and well motivated. The attractiveness of the Volunteer Indefinite program and continuing educational opportunities have provided significant incentives for many to stay in. I would encourage them to take advantage of the many opportunities available to them and consider a full service career. They are to be our majors of tomorrow who will contribute to the future successes of the Corps. Every field grade officer should keep this in mind, and counsel these young officers at every opportunity to insure they are aware of the future that is ahead.

As with the rest of the Army, shortages of enlisted skills and qualifications are being experienced. The Skills Enlistment Option Program, designed to attract personnel qualified in many of the construction skills, has contributed positively to gaining skilled enlisted personnel within the ranks.

ENGR: GENERAL WESTMORELAND HAS SAID THAT THE ARMY NEEDS BETTER LEADERSHIP. HOW DOES THIS APPLY TO THE CORPS OF ENGINEERS?

CLARKE: I think the demand for better leadership in all armies has been universal ever since the first army in history took to the field. Certainly, our Army today and the Corps need the very best leadership the country has available. Our troop leaders are faced with social problems that may not have been present in the past. Racial tensions, drug addiction and the public reactions to an unpopular war all create new problems for our leaders. There is a communications problem between some of our young enlisted men and some of the older officers and NCO's that needs to be solved and poses problems for our leaders. As we move toward a Volunteer Army and a major reduction in strength as the war in Vietnam winds down, the challenges to leadership will be even greater because we must continue to provide the kind of an Army the Nation deserves and needs We see little in the future which would indicate that we should lower our Nation's guard. The challenge to leadership in the Corps will be to do more with less—in terms of both money and personnel.

ENGR: HOW IS THE CORPS INVOLVED IN ENVIRONMENTAL CONTROL?

CLARKE: The most visible part of our activity in the environmental protection field is our permit program. This program establishes a nationwide Federal Permit Program to regulate discharges in the Nation's navigable waters and their tributaries. The Refuse Act—Section 13 of the Rivers and Harbors Act of 1899—prohibits discharges, except from public streets and sewers in liquid form, into any navigable waters of the United States or their tributaries without a permit issued by the Corps. This particular piece of legislation was designed and written to prohibit obstructions to navigation, but the Corps tested its application in non-navigation related matters after several levels of appeal. All applications for permits under the Refuse Act will be referred to the state water quality agency concerned and to the federal Environmental Protection Agency to insure compliance with both state and federal water quality standards before any permit will be approved.

We also have initiated pilot studies to develop regional waste water management systems for five major urban areas in the country; the Merrimack River Basin in New England, the greater Cleveland, Detroit and Chicago metropolitan areas on the Great Lakes and the San Francisco Bay area in California. With the inclusion of waste treatment and disposal plans in our studies of entire river basins, the Corps of Engineers experience in water resource management can now have an equally important role in cleaning up the environment. This is a program that I believe has great promise for measurably improving our streams and one in which I believe that the Corps is uniquely qualified to assist.

Our efforts in the Civil Works Program are changing somewhat in emphasis to reflect the public's growing desire that the development of our natural resources for economic benefits no longer be the sole criteria for our work. Rather, people seem willing to forego, or to pay more for, their immediate needs so that the quality of their environment may be preserved and enhanced for the future. In that light, environmental values are now being given full consideration along with economic, technical, social and other factors when we study alternate means of meeting human demands. We are attempting to keep resource options open for future generations as far as it is possible to do so.

Our construction contacts now require that contractors comply with the applicable federal, state and municipal regulations to minimize environmental degradation on all of our projects. We have issued guide specifications requiring that a separate section of the technical provisions in our Civil Works and military construction contracts be devoted to environmental protection. These provisions cover such things as land defacement by improper or unnecessary bulldozing, erosion control and dust and smoke control.

ENGR: HOW CAN THE YOUNG ENGINEER OFFICER BECOME INVOLVED IN THIS ENVIRONMENTAL CONTROL ACTION WHILE HE IS ON ACTIVE DUTY?

CLARKE: He can become involved with our environmental protection program most directly by assignment to one of our Engineer District field offices where the work is actually performed. The great preponderance of our responsibility for environmental considerations is handled in the Districts. Certainly, post facilities engineers are going to be deeply involved with environmental considerations at their posts so assignments in the facilities engineering field will be another area where a young engineer officer could well become involved with all of the environmental protection activities.

FROM SOUTH OF THE BORDER ---down panama way

by Captain Dennis F. Pierman

Tucked away in the timeless jungles of tropical Central America is an unusual engineer unit affectionately called an ECAD (Engineer Control Advisor Detachment) by Department of the Army. One of two in existence, the 146th Engineer Detachment (Control Advisor —Airborne) is attached to and provides specialized support for elements of the 8th Special Forces Group (Airborne) 1st Special Forces, the Special Force for Latin America.

The base of operations for the 8th Special Forces Group and the 146th ECAD is remote Fort Gulick, which, along with its nearby sister post of Fort William B. Davis, is nestled in the embrace of the Panama Canal on the Atlantic side of the isthmus. Both Gulick and Davis are on sites carved out of the steamy jungle during the construction of the Panama Canal and are surrounded wih mounds and debris of hundreds of abandoned bunkers constructed during World War II. Nearby is Coco Solo Naval Base, a World War II ghost town of empty hangers and windowless buildings which affords the Atlantic area installations the use of its airfield and storage space. All of these military installations are within the political confines of the Canal; one, a U.S. entity established within the Republic of Panama by treaty.

In support of the 8th Special Forces Group and as part of the Special Action Force for Latin America, the 146th ECAD provides specialized engineer-related support to U.S. nation-building activities in that area of the world. Utilizing Fort Gulick as its base of operations, the detachment additionally provides engineer support to the part of the Special Forces mission that deals with the application of the principles of unconventional warfare and internal defense and development of the host countries.

The mission of the 146th Engineer Detachment can be broken down into four discernible areas. The first requires that the detachment maintain the capability to deploy Mobile Training Teams to provide military instruction in engineer-related fields to personnel of the host country. Secondly, the 146th must be prepared to deploy Technical Assistance Teams capable of providing assistance to the military and paramilitary forces of Latin

America in the technical aspects of equipment maintenance and operation, logistics, construction projects and conduct of counterinsurgency operations. In the third area, the unit must be equipped to provide Civic Action Teams to assist the civilian population in nation building activities. Lastly, the 146th must provide physical support in setting up Special Forces Operational bases and furnish guidance to the 8th Special Forces Group command and staff.

Tailored to the advisory concept, the 146th ECAD is organized on three levels, consisting of a 10-man headquarters, two, seven-man control teams and six, six-man advisory teams. The Headquarters Team (KA Team) provides supervision and staff planning for the operation of engineer elements assigned or attached to the Special Action Force. In addition, the KA Team provides an engineer staff to the Special Forces Group and furnishes administrative support for subordinate teams in the detachment. The Combat Teams (KB Teams) provide engineer staff personnel for the Special Forces command and control element subordinate to the Special Action Force. Also the team provides supervision and staff planning, coordination and administrative support for subordinate engineer advisory teams prior to and during deployment on nation-building missions.

The Advisory Teams (KC Teams) are the points of contact who physically deploy to the host country as either Mobile Training or Technical Assistance Teams (MTT or TAT). They are geared to support their own tactical elements of the Special Action Force in counterinsurgency roles and assist and advise U.S. military forces when committed in support of host country forces. The KC Team also advises host country engineer forces on Civic Action type projects in support of nation-building activities. As members of Special Forces, they are authorized to wear the distinctive Green Beret and must be qualified parachutists. Additionally, because of frequent advisory assignments, at least one KC Team must have a Portuguese language-qualified member. Also, there must be at least two Portuguese language-qualified individuals assigned to the KB Team. The remainder of the detachment must all be Spanish language-qualified personnel.

Since its inception in 1963, the 146th Engineer Detachment has been deployed on 147 Mobile Training, Technical Assistance and Civic Action missions to Latin America. Host countries have included every Latin American nation except Mexico, Haiti, British Honduras, the Guianas, the British, French and Dutch protectorates in the Caribbean and of course Cuba.

Individual mission requirements have covered a broad spectrum of engineer-related activities. They include: engineer construction; surveying; maintenance of both wheeled and tracked equipment; equipment operation; road and airfield construction, ferry operation, electrical power generation, sanitation and a host of other important endeavors.

A Mobile Training Team (MTT) concerns itself with classroom and field instruction of selected members of the host country's military organizations. The program of instruction is oriented toward turning the students into instructors in their own right; tried and tested in the reality of their own local environment.

A recent MTT to Venezuela exemplifies the kind of mission with which similar teams have had to contend. A select three-man team was deployed to the Venezuelan Army Engineer School with the mission of training 25 host country counterparts in the operation of a new water purification units. These units were to be manned in conjunction with military units providing civic action and disaster relief. Actual training consisted of 200 hours of instruction and practical exercise conducted in Spanish. As a result of this training, the 25 instructor-qualified Venezuelan engineers learned enough in 45 days of accelerated study to effectively train contemporaries in their own unit.

These specialized teams are designed to provide on-the-spot assistance to host country personnel in the problems encountered in equipment maintenance and operation, logistics, construction projects and the conduct of counterinsurgency operations. Technical Assisance Teams aid immensely in furthering the present U.S. policy of helping developing nations to help themselves. It is perhaps one of the most effective means of providing economic assistance.

In October 1969, the 146th deployed an eight-man team to Guatemala to provide expert assistance in replacing hurricane-devastated bridges on a key road network. Because the time element was critical and economic loss to the Guatemalans was close to $50,000 per day, Baily Bridging was employed over the two, 200-foot spans involved. Aided by indigenous labor, the team replaced the demolished spans in three weeks. In addition to organizing and supervising the installation of the bridges, the team members trained a 200-man force to help in construction and for use in future disaster work.

The last of the three types of engineer missions to Latin America is best illustrated by a recent successful project in the town of Miguel de la Borda in the Republic of Panama. The project was ferry construction at a location selected by the local villagers. The problem was to make the villager's plan workable so the inhabitants of the area could gain access to the economy of the major port city of Colon, 50 kilometers to the north. When the project was completed, the 146th had made a significant contribution to both the economic well-being of the villagers and their pride in themselves at having seen their ideas become reality.

Through its many and varied activities, the 146th Engineer Detachment performs an invaluable service to the United States and our Latin American neighbors. Its MTT's, TAT's and Civic Action endeavors have contributed significantly to economic growth and political stabilization, engendering the hard-to-get respect and friendship of peoples normally too nationalistic to welcome a "gringo."

The 146th is prepared for its important role in a volatile Latin America and is justifiably proud of its accomplishments. Perhaps the future will find it elsewhere in the hemisphere, poised to deploy in support of the nation-building tasks of the Special Action Force.

Captain D. F. Pierman served with the 146th Engineer Detachment from November 1969 to April 1970 as a team leader and later as the adjutant. He is now assigned to the Engineer School as the Special Assistant to the Information Officer.

Gazing through the Crystal Ball

by Colonel Jack G. Becker

Have you ever considered the advantages of having a longer bridging capability for the Armored Vehicle Launched Bridge (AVLB)? Or, how about a skill-oriented, functionalized construction battalion? Or a mine detection capability from an helicopter? Or a controlled explosive device to increase earthmoving capability by 20 or 30 times?

Although this type of thinking may go on in the mind of the engineer in the field, it usually is only a passing thought. However, for he Combat Development Command Engineer Agency (CDCEA), ideas such as these are all in a day's work. Located at Fort Belvoir, Virginia, as a subordinate element of the U.S. Army Combat Developments Command (CDC), the Engineer Agency is eternally striving to meet the Engineer's present and future needs.

Though the Agency's mission has many facets, it is basically twofold. First, the Agency is the spearhead in organizing, informing and equipping the Engineers for efficient and effective operations today.

Secondly, the Engineer Agency functions as the prime catalyst in providing for Engineer organizations and equipment of tomorrow. This phase of activity is conducted in a two-step cycle.

The first step is to undertake studies which define future Engineer roles and capabilities. To do this successfully a certain amount of "crystal ball gazing" must be performed. This "gazing" attempts to identify future Engineer

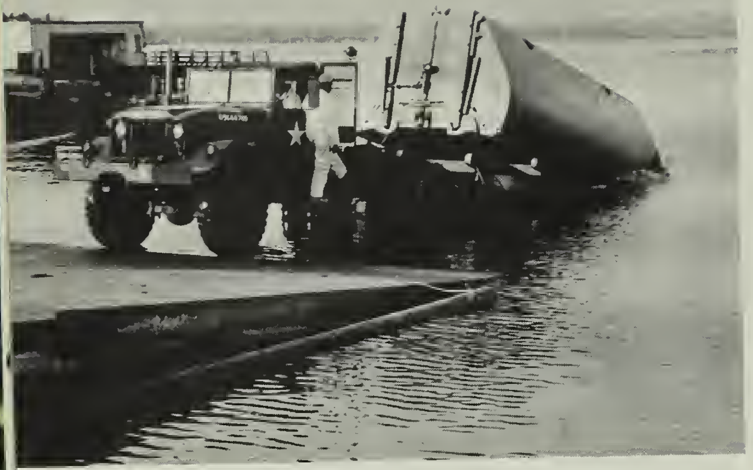
Sections of the Ribbon Bridge being used as a power raft to expedite the river crossing of an Armored Vehicle Launched Bridge (AVLB).

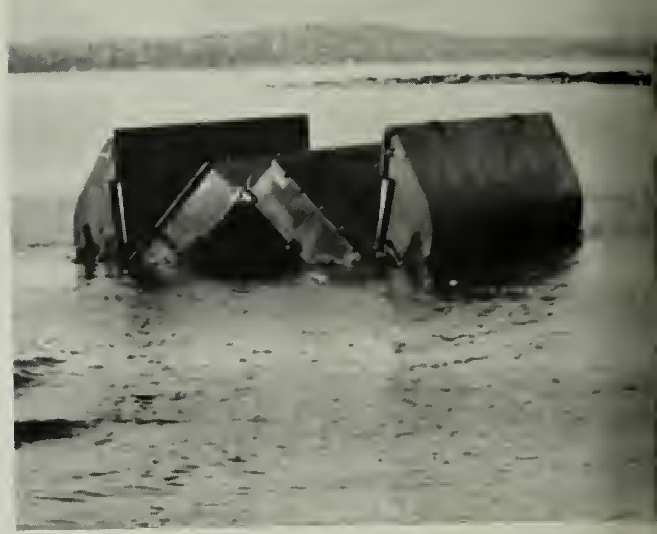
considerations and problem areas. Additional creative analysis must then be undertaken to devise various alternatives or solutions to the indentified problems. Evaluation of these alternatives is accomplished by considering cost, effectiveness and relationship to other Army Forces, to derive recommended solutions. Once this is accomplished, the studies are forwarded through command channels to the Department of the Army (DA) for final approval.

A description of new engineer material required to accomplished future Engineer support is the second step of this cycle. It is initiated during the early stages of the studies, and normally extends past their completion dates. The Agency pursues this task by drawing up the material requirements for new or improved engineer equipment and coordinates them with other elements of CDC, appropriate branch schools and material developers. After approval by DA, these requirements initiate the research and development cycle of new items. The Engineer Agency monitors the item's progress through the research, development, test and evaluation phase to insure that it will meet the needs of the user in the field.

Studies completed recently have dealt with tactical bridging requirements, mine/countermine operations, a Family of Military Construction Equipment (FAMECE), and maps and related terrain data requirements.

One of these studies, "Tactical Bridging for the Field Army in 1975," concentrated on three particular geographic areas where fu-





A section of the Ribbon Bridge during a launching operation. After launching the bridge into the water, the section is unfolded. . . .

ture military activity might be expected. The frequency and nature of the tactical gaps in these areas were established from aerial photography and past terrain surveys. From this data broad requirements for new or improved bridging mehods were derived.

One of the recommendations of this study was that the armored vehicle launched bridge (AVLB) be increased from the present 60 feet to a length of 90 feet. The study also recommended a "ribbon" float bridge for crossing water obstacles. This new bridge provides for a construction rate of 22 feet per minute, at least three to five times the present construction rate.

The ribbon bridge is also adaptable to a raft configuration and can be used to complement the mobile floating assault bridge for ferrying operations. A prototype of this bridge is now being tested on both still and fast water in the state of Washington.

Many Engineers have believed for some time that the construction capability of Engineer units could be increased through the adoption of selected commercial construction equipment currently being used by civilian contractors. Advantages foreseen included the use of the latest equipment, ready access to manufacturers' spare parts sources and the ability to tap the manufacturers' hot production lines in the event of national mobilization. A significant saving was also visualized in research and development costs and in elimination of desirable, but unecessary, military design characteristics.

Impetus toward adoption of this plan was generated by the Vietnam buildup. Civilian contractors with their lates civilian equipment and techniques worked side-by-side in the Republic of Vietnam with Army construction units. On an item-by-item basis the contractor's increased capabilities became very apparent.

In response to the newly stated DA policy to adopt commercial construction equipment for use where such action is advantageous to the Army, the Engineer Agency has identified candidate items and prepared abbreviated performance characterisics for use in procurement of such equipment. The first pilot item being processed is a 25-ton hydraulic truck mounted crane as a replacement for the 20-ton truck mounted crane. Other items, including a 20-ton dump truck, are being worked on.

The Mine/Countermine Study (MICMIS) was conducted by the Engineer Agency in 1970 to examine the organization, doctrine,

Once fully extended in the water, the sections are linked together as required. Engineers preparing for retrieval of the Ribbon Bridge section.

and training aspects of mine and countermine operations. Among other things, the study analyzed operations in Southeast Asia to consider the application of lessons learned there to other areas of the world and various levels of conflict. Primary recommendations of this study included the provision of mine/countermine specialists in many units and staff sections. Also advocated was the adoption of an integrated countermine approach to include surveillance, inteligence, and area denial, as well as mine detection and neutralization.

A major portion of the Agency effort is devoted to the preparation of new TOE's (Table of Organizations and Equipment) and the updating of existing TOE's. The Engineer Agency develops the TOE for the Engineer Battalions organic to various divisions. In a recent revision of the TOE for the Airmobile Division, the Agency succeeded in adding a fourth long needed combat company.

In eleven field manuals, the Engineer Agency is listed as the address to submit changes or corrections. The Agency revises these manuals as required to include the latest doctrine on Engineer field operations. In addition, the Agency offers a service to answer any questions from the field on interpretation of such doctrine.

The Engineer Agency is always on guard for new and unique ideas. To some Engineers, the idea of explosive earthmoving equipment is a "wild, new" idea. But the concept is feasible. Prototypes of the equipment are being tested and the Army may soon realize a tremendous improvement in capability through the application of this concept.

Engineers of bygone days can probably remember the Blast Driven Earth Rod, the Combat Engineer Vehicle, the Mobile Assault Bridge/Ferry or the Armored Vehicle Launched Bridge. These items were also considered "wild, new" ideas, but they grew to be useful items of engineer equipment.

CDCEA is tasked to review, evaluate and refine these types of "wild" and "new" ideas today in order to better prepare, organize and equip the Engineer of tomorrow. The Engineer Agency is proud of its past accomplishments and is constantly rededicating itself to the future of the Army and the Army Engineer.

Colonel Jack G. Becker served as Commanding Officer of the Engineer Agency Combat Development Command, from 21 July 1968 to 7 June 1971.

A Salute to the Corps

by W. T. Spriegel

Engineers have provided combat support in every war and campaign in which the U. S. Army has been engaged. From the trenches of the Revolutionary War to the torrid jungles of Vietnam, Engineer soldiers have stood proudly—leading the way for others to follow.

The history of this country's progress can be traced by the phenomenal engineering feats accomplished by the United States Army Corps of Engineers over the past 196 years. Exploration and surveying of the West; surveying of the Northern Railroad; construction of the Panama Canal; the flood control programs; the planning and construction of our great dams and the Great Lakes Seaway are but a few of such major contributions to the development of the United States.

The Corps is one of our Nation's oldest and most respected military organizations—its history spanning a time frame dating from today back to June 16, 1775 and a resolution of the Continental Congress under which General George. Washington named Colonel Richard Gridley as Chief Engineer of the Continental Army. Since that time, the history of the expansion and development of the Nation from the Atlantic States to the Pacific Ocean and beyond has been marked by engineer accomplishment.

Although Congress commissioned several engineers, Gridley alone retained the rank of Chief Engineer until the Chevalier Louis le Beque DuPortail from France was made Chief of all engineers in the Army, by resolution of Congress in July 1777 with the rank of colonel. He was commissioned brigadier general the following November.

As Chief Engineer, and later as the first Commandant of the "Corps of Engineers," which Congress formally established in 1779, Chevalier DuPortail of France became one of General Washington's most trusted military advisors. He subsequently drew up the plan for a new Engineer Department, which later gave rise to the Corps of Engineers as we know it today, and the establishment of the US Military Academy at West Point in 1802. DuPortail has been called the Father of the Corps of Engineers. For 64 years, until it was placed under the Army-at-large in 1866, "West Point," the first—and for nearly a quarter of a century, the only—engineering school in the Nation was a Corps installation managed by the Chief of Engineers.

Since its inception, the Corps of Engineers' primary mission has been to provide combat support to our fighting Army. The Corp's success is readily evident by the distinguished battle record which engineer troops have racked up over the years. Engineers have been at the forefront in every war and campaign in which the United States Army has been engaged. From Bunker Hill, where Colonel Gridley, the first "pick and shovel" combat engineer, was wounded, after having taken spade in hand to help throw up the defenses which he himself had so painstakingly planned by lantern light the night before—to the steaming jungles of Vietnam, engineers have lent the weight of their considerable talents to speed the advance of friendly forces and to impede enemy movement.

The period from 1802 to 1866, which included the War of 1812 and the Mexican War, dramatized the importance of the United States Army in the development of the Nation as it expanded from the Atlantic to the Pacific Ocean. Leading the way were Army Engineers making early surveys for canals and railroads, extending the National Road, eliminating navigational hazards in the Ohio, Missouri and Mississippi Rivers, opening up harbors for steamships on the Great Lakes and building lighthouses for safe navigation. Others fought Indians while mapping their way across the continent.

During the Civil War winter of 1861-62, the "Battalion of Engineers," as part of the Army of the Potomac, constructed the defenses of Washington, D.C., and performed the many duties assigned to engineer troops as pontoniers, sappers, and miners. They pioneered construction and road repairing and trestle or crib bridges. At the sieges of Yorktown and Petersburg, the Battalion served as sappers and miners, and carried out a vital special assignment—responsibility for the bridge trains which accompanied the Army of the Potomac in all its movements from 1862 to 1865.

After the Civil War and up to the beginning of World War I, Army engineers were occupied mainly with peace-time work. They were managing America's water resources under a Civil Works program which had begun in 1824 with the passage of the first River and Harbors Act; they were directing surveys of the Nations riches in the vast underdeveloped territory of the West; and they were strengthening the seacoast defenses of the United States.

The Corps has been the principal developer of the Nation's water resources. From its initial task assigned by Congress in 1824 of clearing some snags and sandbars from the Ohio and Mississippi Rivers to facilitate navigation, until 1879 when the Mississippi River Commission was created, the Corps' activities in this aspect of civil works was limited to improvements for navigation. With the Commission's formation, flood control became a responsibility—at first in the alluvial valley of the Mississippi as a function incidental to improving the river from the mouth of the Ohio to the Gulf of Mexico, to provide safe passage for increasing numbers of commercial vessels. A few years later the Corps was charged with regulating hydraulic mining in California's Sacramento and San Joaquin Basins. It was also called upon to construct debris basins, and to institute other measures designed to prevent the creation of hazards to navigation resulting from such mining. All inventive minds were active during the post Civil War period. Inventions important to modern engineering were developed. Army Engineers built the great Panama Canal—a peacetime project considered the greatest engineering accomplishment of all time, and one which became vital to National Defense. It was a prologue to the extensive involvement of civilian and military engineers in World War I.

History records that engineer troops were first in action and the first to suffer casualties during that "war to end all wars." At the outset, the Corps was faced with problems of the first magnitude. Engineer supplies of all kinds had to be procured and transported. Timber had to be acquired through negotiations with the French, to construct training camps, supply depots, hospitals, barracks and housing. Engineer units built hundreds of bridges, repaired and constructed roads—and special engineer troops were designated to provide water supply. Searchlight units were trained and sent to France for defense against night bombing. Engineer schools for officers and enlisted men were established both in the United States and France to meet the demands placed on the Corps of Engineers. When the firing ceased, engineer troops remained to assist in the rehabilitation of France.

At Normandy in World War II, the first soggy GI boot was that of an engineer who, with his fellow trooper technicians, stormed ashore to clear the beaches for the Infantry. Combat engineers carried out three-fourths of all major landing operations during that global conflict. Following a long established pattern, engineers were in the advance element in every theater of operations, with newly developed engineer devices such as bulldozer blades mounted on medium tanks helping American armor slice through Brittany, across France and into Germany. In the Pacific, engineers created airfields in the jungles, built the Ledo and Burma Roads, and transformed wilderness into huge bases and ports. Immediately after Pearl Harbor, the Corps of Engineers was made responsible for military construction in the United States, previously a responsibility of the Quartermaster Corps. Army Engineers built more than 3,000 command installations, 500 camps, 765 airfields, 300 major industrial projects, 167 storage depots, and thousands of miscellaneous military facilities. They constructed the Alaska (Alcan) Highway reaching 1,523 miles from "head of steel" at Dawson Creek, British Columbia, through the Yukon Territory to Fairbanks, Alaska—and carried out the epic assignment of helping to develop an atomic bomb.

When, in June 1950, United States forces were again mobilized against communist aggression in Korea, engineers rallied to their motto of "Essayons" (Let Us Try) to pit their skills against engineering problems imposed by rugged country dominated by rocky, treeless mountains, narrow valleys, swift rivers swollen by summer rains, and would-be roads—little more than trails—winding through mountainous terrain or along dry river beds.

In the early stages of desperate, hard fighting in that land, engineers laid aside their tools and desire for enginering accomplishment, and as a necessity grabbed their weapons and assumed their secondary roles as infantry troops. The success with which they performed in that capacity is well documented. One of the most important accomplishments of Engineer troops during the Korean war, among many other combat situations which they faced, was the particularly brilliant

rear-guard action they fought to protect troop withdrawals from the Yalu River. For these men, no job was impossible in one of the most rugged areas of the world. And during the Korean period, Army engineers built strategic air bases at remote locations throughout the world, including Greenland and North Africa; constructed a complete line of supply and communications facilities across the breadth of France; and established air raid warning systems in Labrador and Greenland.

Today the Corps of Engineers continues in its military functions by providing engineer combat and construction support to all units of the Free World Forces now serving in the Republic of Vietnam. Courageous, energetic and resourceful, engineers face the steaming jungles, monsoon rains, dust, sand and mud to overcome the problems which only they, with their consumate skills, dare to attack. In Vietnam, Engineer battalions have succeeded in completing construction projects which constitute some of the most startling achievements of modern times, and a major boost to the program which we commonly refer to as Vietnamization. The three jet-capable airbases existing in that country in 1965 were increased by fifteen in four years.

They increased by nine-fold the number of airstrips capable of accommodating the relatively large C-130 transport aircraft, while the two deep-water ports were increased to seven. In one year alone, troop construction forces built port structures with a capacity of more than 9,000 tons a day, storage facilities for more than a half million barrels of liquid fuels, hospital facilities totaling over 1,400 beds . . . a million square feet of closed storage . . . one half million cubic feet of refrigerated storage space . . . and housing for over 150,000 men. These were construction support projects. Meanwhile, combat support . . . road building, bridging, demolitions, airstrip and landing zone construction was on-going at the same time. Engineers have applied their skills to further the slow, tedious process of Vietnamization . . . rural development, repairing schools, providing potable water sources, drilling wells, improving sanitation systems, rehabilitating public institutions and erecting housing. Throughout this Nation's history the Corps of Engineers has both fought in the front lines and constructed the field military installations, roads, bridges and fortifications the Army has needed to do its job.

During the past 145 years, the Corps of Engineers has completed over 3,200 Civil Works projects. It has built over 19,000 miles of inland and intracoastal waterways now in commercial use, and 500 coastal Great Lakes, and waterway harbors, including almost all those through which the United States carries on its vital domestic and foreign trade and 250 small boat harbors, and harbors of refuge. It has constructed some 350 reservoirs and local flood control projects incorporating over 9,000 miles of levees and flood walls, and 7,500 miles of improved channels. Flood control projects built by the Corps have so far prevented more than $16 billion in flood losses, over three times the amount invested in flood protection. Corps hydropower plants in 50 projects have a total generating capacity of nearly 12 million kilowatts. Recreational attendance at Corps reservoirs during 1969 was in excess of 254 million. One hundred and fifty fish and wildlife management areas have been established around these lakes, as well as 400 state, county and municipal parks. In time of flood or hurricane, the Corps provides assistance in damage control, rescue work, and rehabilitation both under its own authorities and as engineering agent of the Office of Emergency Preparedness. Since 1863, it has been involved in more than 100 disaster operations, including more than 90 floods and hurricanes.

We pay tribute to the Corps and its members who celebrated yet another anniversary in June by paraphrasing a line from a song which is sung with gusto at one of our leading civilian engineering institutions—

IT'S A HELUVA, HELUVA, HELUVA CORPS OF ENGINEERS!

W. T. Spriegel joined the staff of the US Army Engineer School in September 1962 as Information Officer, and currently is assigned as Deputy Information Officer of the U.S. Army Enginer Center and Fort Belvoir.

Mapping the Future

by M. J. Tercy

Since the dawn of time, men have gazed into the heavens and observed the celestial wonders stretched endlessly before them. However, few men ever dreamed that the future would provide them with the means to reach out and explore these mysterious bodies of light.

It wasn't until almost four centuries ago, that Galileo first scanned the stars through his telescope. This new invented apparatus, although crude in design, gave him the tool to study in detail the mysteries which had puzzled men for so long. Through the use of his telescope, Galileo directed his attention to the moon, making sketches while he observed. In doing this, Galileo produced the first lunar maps.

With the efforts of Galileo, mankind embarked on a new adventure—the study of the moon. In our own time, we have witnessed astronauts leave the confines of our planet to actually land upon and explore the lunar surface. But the success of their mission has been the product of research by the successors of Galileo, who have stepped across the void of space to map the moon.

Early Moon Mapping

Without the use of modern techniques or equipment, the early moon mappers produced remarkable results. Perhaps one of the greatest obstacles to these observers, was the poor resolution power of the telescope or the inability to obtain a sharp clear image. This was compounded by the chromatic aberration or color distortion caused by the refraction of light through a lens.

Galileo had predicated that by simply increasing the focal length of a telescope, it would only serve to magnify the subject, but not clearify its image. As telescopes became larger, this theory was proven. The detail of the image became no greater due to the poor resolving power of the simple lens system. Because of this the accuracy of the early lunar maps relied heavily upon artistic interpretation. Even the best lunar representations of that period, although noteworthy in achievement, lacked accuracy in the positioning of detail.

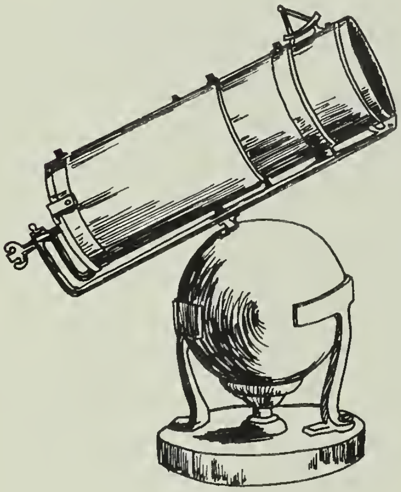
In the latter half of the 17th Century, a French astronomer, Cassini, stretched the limit of lens resolution by producing a lunar map 21 inches in diameter. This was perhaps the best lunar map of that era. But it wasn't until a century later that the problem of lens resolution was to be solved. In 1758, John Dolland, an English optics maker, invented a system of correcting for refractory color distortion. He used different types of glass in composite system of lenses. Adapted to the telescope, it gave rise to a new era in astronomy and opened the way for precise plotting of lunar detail.

The first system of coordinates of the moon was developed in 1748, by Tobias Mayer, a German mathematician. His system enabled observers to determine actual position of lunar detail such as craters, mountain ranges, and "seas." Mayer led the way for new interest in lunar maps.

The 1800's produced dramatic studies in lunar map making. The reproductions made were larger and more precisely detailed than ever before. Positions on the lunar surface were defined by measuring the bearing and distance of craters. For greater accuracy, these measurements were made at various phases of the moon and took into consideration the swaying effect of the moon on its axis called "librations."

An example of an early moon map. This map done by Cassini in 1680, represents the best mapping efforts of that period.

A technician sketching the initial terrain relief with the use of a multiplexer. This instrument allows stereoscopic viewing of a given map area.



A technician tracing map relief with a "pantograph router" . . . The information received is transformed into 3 dimensional figures.

Observers could now create a basic geodetic control. A series of points could be measured and plotted, and a network of control points established. By establishing this series of interrelated points, secondary points of detail could be measured and plotted, then by simply linking and relating one point to another the entire visible surface of the moon could be accurately mapped. The maps compiled through use of these methods came close to the idea of a modern map. Refinement of the systems employed in their production, actually gave us the basis for present day techniques in lunar mapping.

Photographic Mapping

The idea of producing lunar maps from photographs was first conceived as far back as 1859. The factor which limited these efforts was the inability to measure the scale of photographic plates. As the state of the art advanced, methods of measurement were developed. Finally, in 1865 L. M. Rutherford made the first photographic maps of value to astronomers.

Further developments occurred during the turn of the century, as Julius Franz and S. A. Saunder set out to develop a new system of lunar coordinates. From the measurement of photographic plates, they established coordinates of longitude and height. They worked from a central point on the lunar surface, nearest the intersection of the moon's equator and the 0° degree meridian, calculating a network of 3500 control points. The degree of accuracy was so great, the "Franz-Saunder" system as it is called today, is the current reference for control and navigation on the lunar surface.

Compilation of modern moon maps, relies completely on photographs. The sources vary from advanced telescopic observations to pictures taken on the lunar surface by the astronauts. Methods are now so precise, that features as small as three feet in diameter can be accurately described and plotted. But with all the technical advances in present day moon mapping, one limitation still exists. Only 59 percent of the moon's surface is visible to the earthbound observer, and the techniques employed to record it are difficult and time consuming. Forty-one percent of the surface is always visible, but the remaining 18 percent can be viewed only at certain times during the moon's eighteen year orbital cycle.

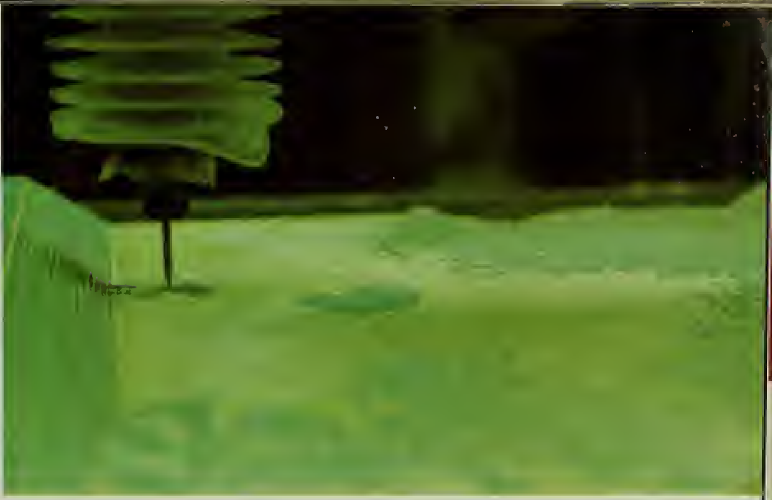
One technique employed in gathering these photographs is "time lapse" photography. This enables a larger number of photographs to be taken at short intervals, adding to the amount of different perspectives photographed. By viewing a given area at different angles, it then becomes possible to determine the height of the terrain and then plot the relief. The only drawback to this method is the inability to make direct measurement from the photographic plates. Mathematical computation must be used and the results at best are estimates, not actual linear measurements. To obtain these direct measurements the photographs must first be rectified to compensate for the curvature of the sphere.

To achieve this effect, the pictures taken were projected onto a curved screen with the use of specially designed projectors. This method removed the perspective view and displayed a flat image from which direct measurements could be taken. However, with the current demands for precise accuracy and short production time, computers took over the function of rectification through the use of electronic scanning devices. A further refinement of lunar photography, made use of stellar positions in the field of the picture. By relating these known points to positions on the lunar surface, a higher degree of accuracy of lunar coordinates was assured.

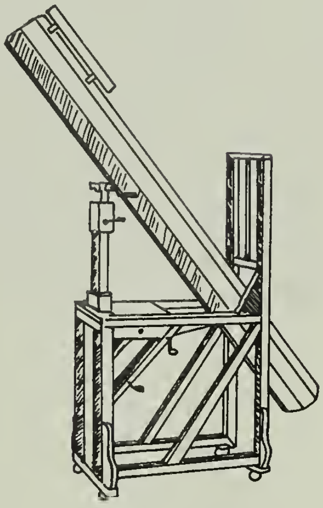
Mapping by Satellite

With plans to land a man on the moon, it was necessary to develop both new and more accurate sources of photographs and new techniques in map production. The material required was provided by satellite photography, utilizing the same basic principles used in aerial photography of the Earth.

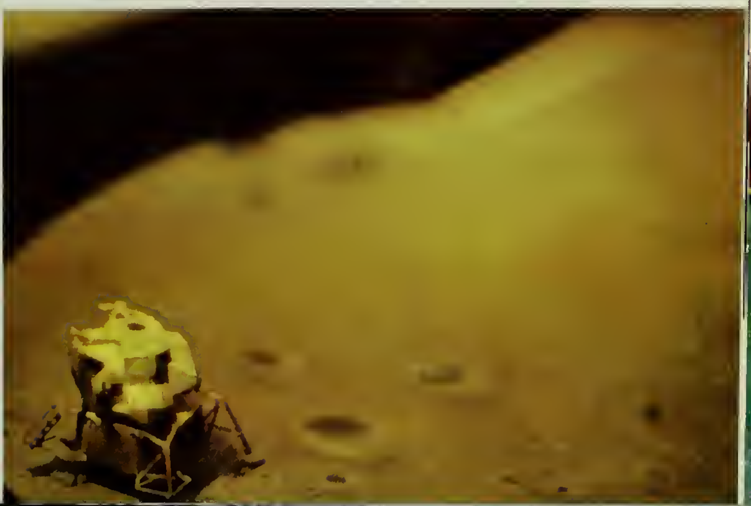
The first series of satellites launched, were the Ranger and Surveyor. These were designed to transmit back information of the nature of the surface terrain. Ranger was the first to be used. The plan was to take photos in sequence while the craft was descending to the surface. Even though the data received was limited to one area and one perspective of view, the photographs showed detail 1,000 times more accurate than the most powerful telescopes used on Earth. The second craft, Surveyor, "soft-landed", sending back photographs taken from the lunar surface. These pictures assisted the map makers in interpreting relief features from a horizontal or plane perspective. Although the Ranger and Surveyor satellites



The 'pantograph router' carving 3 dimensional terrain relief on a map.



A model of the LEM on a three dimensional lunar terrain map.



A model of the Ranger III satellite. Its predecessor was the first satellite to transmit photographs of the moon back to earth.

provided interpretation of terrain features, they were not used for producing actual maps.

The next series of satellites to be launched were designed for mapping only. Appropriately, the name of the mission was Orbiter. The first three missions were sent up to photograph the equatorial belt of the moon, in order to map areas of possible landing sites for lunar exploration. The missions which followed gave further detailed information. While photographing the surface, they also relayed back flight data and recorded the positions of stars as reference points. All this information relating to the photographs gave highly accurate detail as well as precise measurements of positions. By the late 1960's the Orbiter mission had completely photographed almost the entire lunar surface. The maps produced from the Orbiter photography exemplified the most accurate and most advanced state of map production. The practical application and success of Orbiter missions is undisputed as the lunar landings have proven their value and accuracy.

Maps for the Astronauts

As the National Space and Aeronautics Administration (NASA) was preparing to launch its first manned lunar mission, Apollo, it required a great number of detailed maps for training, navigation, and exploration. The need was fulfilled by the Army's Topographic Command (TOPOCOM).

Probably the most important phase of preparation for the lunar expedition is the training. A Lunar Module Simulator (LMS) was produced to provide realistic training on the ground for the Astronauts. This device simulated every phase of lunar flight from the approach to the lift-off from the lunar surface. An important part of the "LMS" is a three dimensional relief map of enormous proportions. TOPOCOM produced this model meeting the most demanding requirements.

To date, TOPOCOM has produced five lunar models for use in the LMS. The most recent of these, and the one now in use is a model of "Hadley's Rille," the proposed landing site for Apollo 15. The actual size of the model is 16′ by 25′ and is scale to 1/2000 of an inch, representing approximately 40 square miles of lunar surface. The features are so exact that objects five meters actual size are detailed on the model. There are over 10,000 such features in all represented on the model of "Hadley's Rille."

The time spent in construction of this map was approximately 18 weeks. This showed remarkable improvements in production time, since the first models took as long as nine months to build. The factor which accounted for the change was use of a urethane material (a type of styrofoam) as opposed to the use of standard plaster casts.

The first step in production is to cut topographic relief into blocks of urethane with the use of a pantograph router. This device enables the technician to trace the relief from a lunar map and have it directly transcribed three dimensionally on the urethane blocks. This forms a "negative" model. The sections, which are 24″ by 24″ by 4″, are then finished by hand carving and sanding, progressively stacking the pieces and joining them into larger sections. This is continued until there are three major sections. These are then shipped from TOPOCOM to the John F. Kennedy Space Center where a final positive model is cast using an expoxy-resin material.

Once installed in the LMS, the astronauts view the lunar surface from their module through the use of a computerized mobile TV camera. The model area is magnified 2,000 times to produce an image which appears like the real thing. The astronauts confirmed its likeness by exclaiming from a descending lunar vehicle "There it is, right where it's suppose to be."

In addition to the LMS model TOPOCOM also provided NASA with additional technical data for navigation and exploration. The Apollo Landmark Maps, are used onboard the spacecrafts, mapping easily identifiable landmarks on the lunar surface. This combined with the use of star charts allows the astronauts to pinpoint positions and evaluate the accuracy of the ground data. Once on the ground, the astronauts make use of gridded terrain maps to establish their general location and to carry out their lunar walks. The planning for this is done at the Houston Space Center using smaller plastic models scaled to 1:12,500 of an inch.

TOPOCOM is already in the planning stages of their next production for the Apollo 16 mission. The proposed landing zone is near the crater Descartes, and photographs from the Orbiter satellites are again being compiled into maps. Once NASA finalizes the touchdown site, TOPOCOM will link past studies with modern technology to provide its invaluable assistance as mappers of the moon.

The end product of man's effort to map and explore the Lunar surface.

Lam Son 719

This moving account of U. S. Army Engineer activities in support of Army, Republic of Vietnam operations during the Laos incursion points up the magnitude of the Corps' diversified role in a combat situation.

The support mission carried out by the U. S. Army's Corps of Engineers has proven time and again to be diverse and always a challenge. One such challenge was met by the Engineers during the incursion into Laos. The events that occurred during the incursion which was called LAM SON 719, displayed what could be done under stress from an unseen enemy and in a short period of time.

Corps personnel carved roads out of mountainous jungle terrain and airfields were constructed to clear the way for the combat forces. The success or failure of the operation depended entirely on the ingenuity and flexibility of the officers and men of the Corps and once again they contributed invaluable aid. The following information constitutes the untold story of LAM SON 719.

In December of 1970, the premier of North Vietnam, Phan Van Dong, said "Our military, political and diplomatic strategy is a protracted war—a people's war"! Perhaps this statement best reflects the enemy effort in Southeast Asia throughout 1970. His commitment to a long-term war was characterized by mass population mobilization in the north. This action on the part of the enemy could be interpreted in many ways, but the most obvious was the increased need for men and materials in the south.

The need for logistics support has always been a problem which has confronted the enemy. In the past, three major lines of communications have been used. Each one has been systmatically cut to suffocate enemy activity and hopefully bring it to a grinding halt. Sampans and junks operated along the coastal areas feeding supplies to the interior regions. Also the port of Kompong Son (formerly Shihanoukville) in Cambodia was a major supply route supporting enemy combat activities in Cambodia and the southern portion of the Republic of Vietnam (RVN). The last of the three major logistical routes is the Ho Chi Minh Trail in Laos. This road network has more than 1,500 miles of motorable roads which encompass the entire panhandle area.

Allied operations have effectively cut the coastal supply traffic, and the disposition of Prince Shihanouk ended the enemy's access to the port of Kompong Son. Also last year's Cambodian sweep, denied the enemy the use of his sanctuaries along the Cambodian-RVN border. The consolidated result of this series of events seriously dampened enemy combat effectiveness. Because of this, the enemy was forced to expand his area of operation in Laos.

Traditionally, the major enemy logistics effort occurs during the dry season which extends from November through April. The buildup starts in North Vietnam's sector of the panhandle in late September and early October. And since the American bombings have ended in the north, the enemy has had little difficulty in moving men and materiel through this area from the north.

The supplies are brought to staging areas such as Vinh, Dong Hoi, and Quan Khe. They are then introduced into the Lao Panhandle where they eventually find ther way south. The supplies reach the areas in Laos from late October to early November. Then, as road conditions improve into the dry season, the infiltration increases achieving its highest levels during the months of February through April.

The supplies which move through this system are varied. They include food, weapons, ammunition, fuel, medical supplies, communications equipment and administrative supplies. The transportation of these supplies is as varied as the supplies themselves. Movement is carried out by porters, animals, bicycles, trucks and even boats. Even though the methods are known, the destinations of these goods are exceptionally difficult to estimate due to the thick jungle terrain of the area.

Cutting off this principle means of supply is equally difficult to accomplish. Not only is there difficulty in locating targets for destruction but the buildup of enemy anti-aircraft defenses has increased the threat to air assaults. The enemy has taken great measures in protecting his supply corridor in Laos. The use of the Ho Chi Minh Trail is now the only route of effective support left to the enemy.

The increased level of activity along the Ho Chi Minh Trail and the buildup in the panhandle area posed a definite threat to the security of Allied Forces in the northern part of RVN. To counter this activity and effective-

An aerial view of the Khe Sanh airstrip.

An aerial view of the "Red Devil" road.

Engineers span a tributary of the Quan Tri River with an AVLB.

Engineers begin cutting a road through the thick jungle.

The "Red Devil" Road to Khe Sanh.

The main airstrip at Khe Sanh overlayed with MX-19 matting.

ly stop it, a major operation was planned and carried out on January 30 of this year and lasted through April 8. The operations were designed to strike at supply and storage areas and to block infiltration routes leading into the western part of the region.

The American responsibility was limited to the initial phase of the operation. This involved the movement of the Army, Republic of Vietnam (ARVN) Airborne Division and a brigade of South Vietnamese Marines from Saigon to staging areas in the north around Dong Ha. Upon arrival of the troops, a massive engineering effort was launched by U.S. Engineering Units supported by U.S. Combat Troops. There were three major engineer elements involved in the operation, whose overall mission was to open road networks through the operational area. An additional responsibility was to open and repair the existing airstrip at Khe Sanh to accommodate large scale traffic.

The engineering phase of the operation was initiated by the 45th Engineer Group, which was given the specific mission of opening Route 9 to Khe Sanh and then on to the Laotian border. Additionally, they were to repair the Khe Sanh airstrip with the assistance of TF 326, an engineering element organic to the 101st Airborne Division (Airmobile). At the same time Company A of the 7th Engineer Battalion was to construct a new road from Route 9 to Khe Sanh. This would provide an alternate route to Khe Sanh for the upcoming ground forces.

The entire unpaved length of Route 9 extended a total of 39 kilometers. This operation required a major engineering effort which included the repair, replacement or bypassing of 33 bridges. The greatest obstacle occurred at Bridge 9/36, which crossed a major tributary of the Quang Tri River. The abutments of the original bridge which was bombed out, extended 184 feet above the river bed. This obstacle was breeched by the use of the Armored Vehicle Launched Bridge (AVLB).

The 45th Engineer Group opened Route 9 to Khe Sanh for wheeled vehicles the day after the operation began. It was then opened to the Laotian border for tracked vehicles on the third day of operation, and upgraded to handle wheeled vehicle traffic on the fourth day. Throughout the entire operation, Route 9 was continually upgraded and by the completion time, it was opened to two-way traffic for virtually its entire length.

The alternate road from Route 9 to Khe Sanh was begun on January 30. The total length of the road was 23 and a half kilometers. Within 10 days after the operation began, a rough pioneer road was completed. The road became known as the Red Devil Road and was subsequently upgraded to handle wheeled vehicle traffic. In all, Company A of the 7th Engineer Battalion completed a total of 80 kilometers of road network throughout the operational area.

Another phase of the Engineer activities was the repair of the airstrip at Khe Sanh. It took four weeks to repair due to extensive bomb damage. TF 326, which was to assist 45th Engineer Group in repairing the airstrip, was airlifted directly into Khe Sanh to begin work. They constructed a 3,200-foot by 60-foot assault airstrip parallel to the main runway. The first C-130 to land on the airstrip arrived on February 5th, but the Air Force had determined that the packed earth strip was unsatisfactory for prolonged use due to weather conditions. The runway was upgraded by the use of MX-19 Matting, and became an operational strip on February 15th.

According to all indications, Operation LAM SON 719 and Operation Toan Thang 01/71 which followed it, proved to be an overwhelming success. The ARVN ground forces effectively disrupted vital portions of the enemy's logistics system. They captured or destroyed significant quantities of enemy supplies, and inflicted considerable damage to enemy combat forces in the operational area.

Both operations have placed the enemy on the defensive, forcing him to divert his troop commitment to large defensive operations. In all, LAM SON 719 was more than just another successful operation. It was another challenge met, and job well done with a big assist through the support of the Corps of Engineers.

An Air Force C-130 lands on the completed Khe Sanh airstrip.

The abutment in the right foreground was all that remained of the bridge across the Quan Tri River.

Engineers "Clearing the Way".

THE HENRY LARCOM ABBOT AWARD

A Management Breakthrough

by Captain F. W. Bockman

WITH AN INCREASING NEED FOR FLEXIBILITY AND CONTROL IN CONSTRUCTION PLANNING, THE CRITICAL PATH METHOD HAS GIVEN THE ENGINEER A NECESSARY TOOL FOR MODERN EFFICIENT MANAGEMENT.

Until a few years ago, project managers and job superintendents had no formal procedure to aid them in the management of construction projects. Managers relied primarily on technical requirements, past experience and information derived from a bar chart.

Personal judgement and reliance on a bar chart had several disadvantages. The principal difficulty is demonstrating and explaining the interrelationships of work activities. The level of detail on a bar chart is also restrictive. Due to these restraints, if a manager became ill or had to be replaced, his replacement had great difficulty in continuing the job plan. Overhead cost and probability of mistakes on the job site were increased. Another restraint was the lack of a common plane of reference in progress reporting. These and other management problems caused the construction industry to try several approaches, none of which was quite successful, until the latter part of the 1950's.

In 1958 and 1959 a team of people at DuPont developed a networking system which overcame the disadvantages of the bar chart. They used this system, which they called the "Critical Path Method" (CPM), on maintenance and construction projects: At approximately the same time, a research team developed a similar system to be used on the Polaris missile project. This system was called the "Program Evaluation and Review Technique" (PERT).

The primary difference between the two systems is that CPM uses one time value for the activity durations and PERT uses, by statistical methods three time values. PERT is used principally on research or design projects where time values are very difficult to judge. CPM is used on construction projects in which time can be estimated with a higher assurance of accuracy.

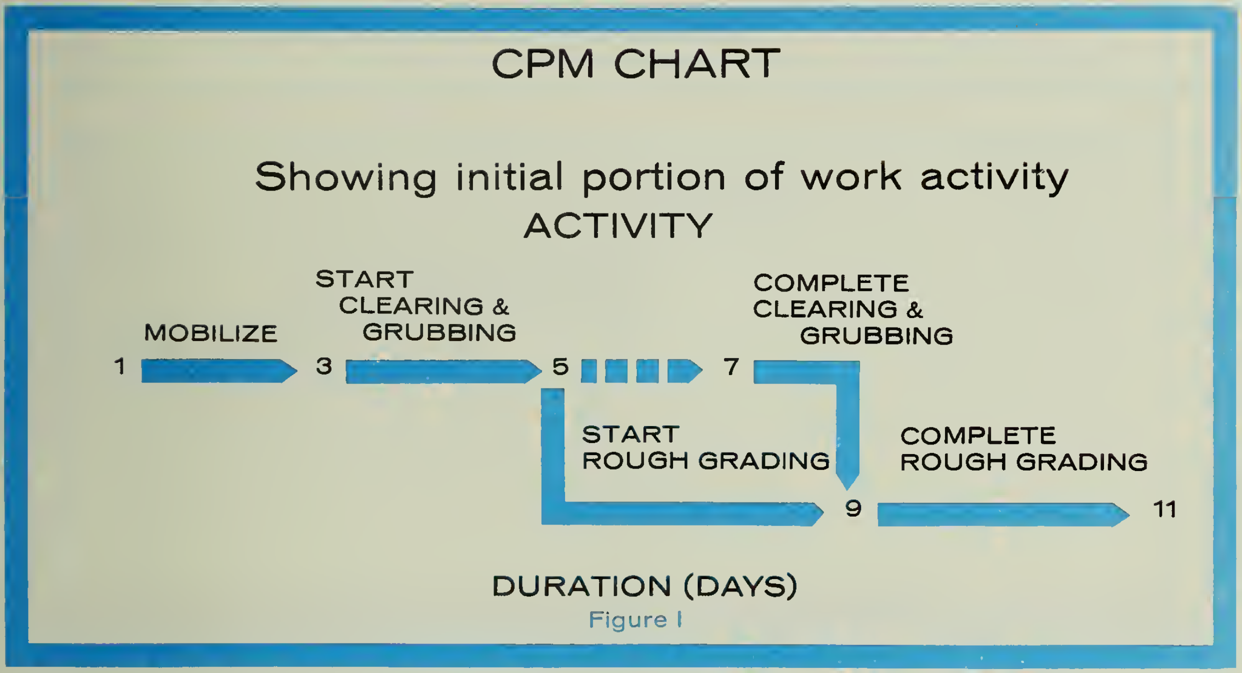

CPM CHART
Showing initial portion of work activity
ACTIVITY
MOBILIZE
START CLEARING & GRUBBING
COMPLETE CLEARING & GRUBBING
1
3
5
7
START ROUGH GRADING
COMPLETE ROUGH GRADING
9
11
DURATION (DAYS)

Figure I

The basis of both the CPM and PERT systems is the network diagram. With the network diagram two important additions have been added to the existing systems. They have added a visual relationship or interdependency of various activities, and a more detailed listing of activities. In figure 1, the example given shows three different activities. Even though the example displays a small portion of the overall operation, one can readily see how the CPM network allows the manager to graphically display how one activity affects the other.

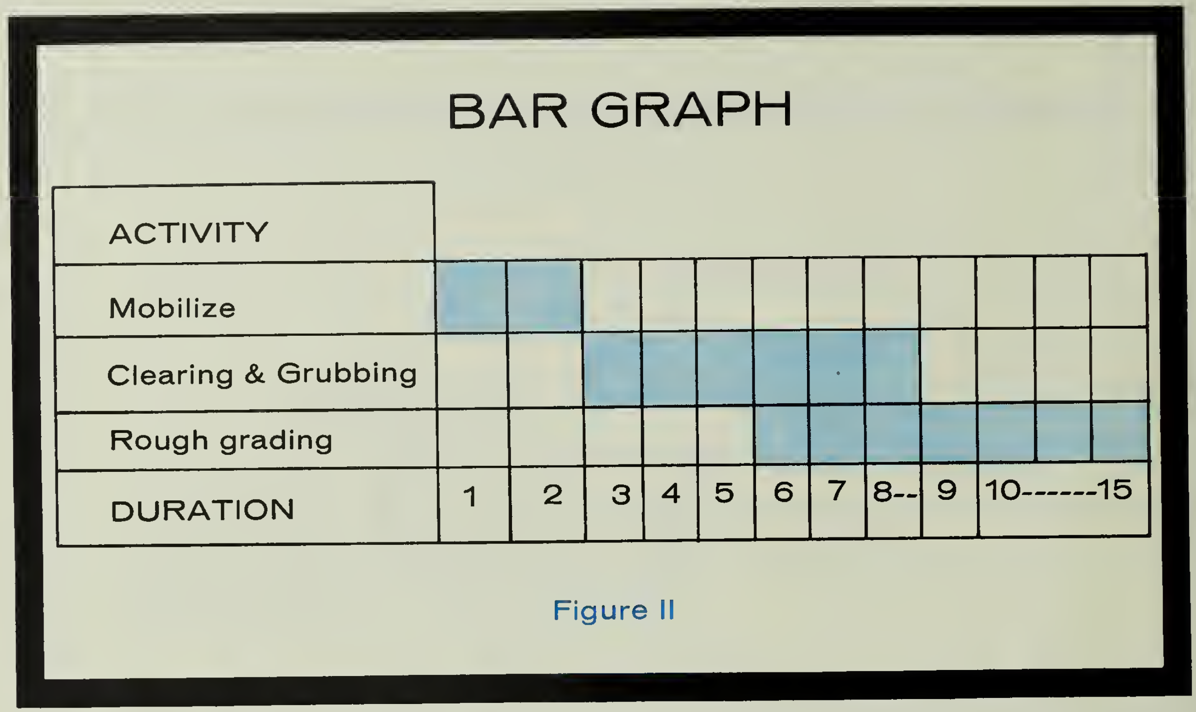
The network not only shows proper relationships, but if a series of math computations are made, the results will give the expected start and finish dates of each activity as shown in Figure III.

Day one should be taken as the start of a job. By use of a calendar the various start and finish dates could be converted to calendar dates.

The main disadvantage to CPM and PERT has been the long and tedious hand calculations necessary in these systems.

With the growth and acceptance of CPM and PERT came a corresponding increase in Automatic Data Processing Systems (ADPS) to support these techniques. The newer computer programs that have been developed now allow the managers to process networks of thousands of activities in a matter of minutes.

These new programs have taken the basic CPM network of work activity and time and allowed the manager to add activity, cost, manpower, equipment, and skill codes. By use of these new programs a manager can incorporate this additional information in his CPM schedule and obtain the basic activity time schedule as well as the cumulative dollars, cumulative labor, manpower, cost outlook and equipment schedule reports. This information has made the rewards of using CPM



BAR GRAPH

ACTIVITY												
Mobilize	▨	▨										
Clearing & Grubbing			▨	▨	▨	▨	▨	▨				
Rough grading						▨	▨	▨	▨	▨	▨	▨
DURATION	1	2	3	4	5	6	7	8--	9	10------15		

Figure II

and PERT much more beneficial to the manager who must perform the job.

The above mentioned print-outs are but a few of the options available when CPM and ADPS are combined as they are in the civilian world. But what about the good old Corps of Engineers?

In the majority of Engineer Districts in the United States there is a requirement that any job above a certain dollar size incorporate CPM. These requirements specify information that allows the district to better monitor the construction progress and job plan. An additional benefit of this schedule is that it permits the local representatives of the district and the contractor to have a plane of reference for further discussion of job progress and monthly job payments.

The development and use of CPM at the district level has given the contractor the freedom of building his own construction schedule. The district representative of the Corps and the contractor arrive at a true representation of progress, in respect to time remaining and monthly payments versus progress, by adding the construcion cost for each activity.

The use of ADPS and CPM has mechanized a large amount of paper work involving monthly payments and job progress. This mechanization frees the resident engineer from his office and allows him to add many hours to his primary job of guaranteeing the proper construction of Corps of Engineer projects.

On the military side of the Corps of Engineers, how much is known and used of CPM techniques? What capabilities exist at battalion and company level to make use of this superb management tool?

Every officer who attends the Engineer Advanced Course receives a basic understanding of CPM procedure and an introduction to PERT. He is familiarized with such terms as crash cost, equipment scheduling and other procedures developed in CPM. Facilities are

JOURNAL OF ACTIVITIES

Activity	Description	Duration	Early Start Day	Early Finish Day
1-3	mobilize	2	1	2
3-5	start clearing & grubbing	3	3	5
5-7	dummy	0	5	5
5-9	start rough grading	5	6	10
7-9	complete clearing & grubbing	3	6	8
9-11	complete rough grading	5	11	15

Figure III

made available to him to use a small computer program. There he can see the difference in the time required to hand calculate a CPM network and the computer calculation time in initialization of a network and updating of this network. The Advance Course Officer will leave with a sufficient background of knowledge that can be easily expanded by extra reading.

Once this officer returns to a company command or a battalion job he can develop an excellent CPM network with equipment and manpower estimates incorporated. However, if the network is of such size that it can not be hand calculated, his work is in vain. The battalion or group level has no data processing capability that will assist this man in his work. Regardless of his desires, the network must be developed so that it can be hand calculated, requiring many hours and allowing a much greater chance for error.

The civilian managers realized the profits of combining CPM and PERT networks with Automatic Data Processing Systems many years ago. Even the district level of the Corps of Engineers has combined the two processes to lighten the resident engineer's paper work load and allow him to spend this time more beneficially.

The military side of the Corps of Engineers pays lip service to this principle. It is imperative that proper scheduling techniques be used at battalion and company levels to insure that correct manpower and equipment is used to reach a realistic completion date. Until the Corps of Engineers makes available adequate CPM programs and Data Processing equipment to the people who must supervise the work at battalion and company level, it will never realize the full benefits of the Critical Path Method and Program Evaluation and Review Technique.

Captain F. W. Bockman is a graduate of the University of Alabama with a degree in Civil Engineering. He is currently a student attending the Engineer School's Officer Advanced Course.

Bridging

Efficiency Reports Can Make or Break An Officer's Career

"For want of an efficiency report, a promotion was lost, for want of a promotion a career was lost." This modern day adage aptly describes the significance which the Army places on the efficiency report. The report is the single most important document rendered by or about any officer. It is used in making virtually every decision regarding an officer's career. Promotions, schooling, assignments, appointments in the Regular Army all largely depend on the efficiency report. However, despite their importance, many reports arrive at Department of the Army long after the 45 day deadline required by AR 623-106. A punctual report could be the factor that tips the scales in favor of the officer concerned. If you have an efficiency report to write, start and complete it within the allocated time period. Remember someone's career is in your hands and maybe even your own.

Army To Name Next CGSC Selections Late This Fall

The Command and General Staff College selection process for the course beginning in August 1972 will take place this summer and early fall. Selection lists are normally published in late November or early December. The zone of consideration includes all officers with seven through 15 years of commissioned service as of August 31, 1971. Due to quota restrictions, only 46.6 percent of the Corps' lieutenant colonels and promotable majors have attended the CGSC resident course. Officers beyond their final year of consideration for the course are strongly encouraged to obtain credit through completion of the nonresident extension course. It will assist in assignment opportunities and promotion considerations. Application for nonresident training may be made in accordance with AR 350-60.

Earn Master's Degree Through ROTC Program

The Advanced Degree Program for ROTC Instructors Duty (ADPRID) is a relatively new program that offers Engineer officers an excellent opportunity to enhance their education. The first part of the two-part program gives the officer a maximum of two years of study under the Degree Completion Program to obtain a master's degree in a field related to Army requirements, excluding law. Upon receiving the degree, the officer remains at the same school as an ROTC instructor for a minimum two-year stabilized tour. Applicants who already possess a master's degree will be assigned a three-year stabilized tour as an ROTC instructor. Letter applications are accepted at any time. To learn more about the program read DA Circular 621-7 dated February 23, 1971.

the Gap

Advanced Courses Open to Qualified Engineer Officers

This year a limited number of Engineer Officers will be selected to attend Advanced Courses at the Infantry School (Fort Benning); Armor School (Fort Knox); and the Amphibious Warfare School (Quantico). Selection for attendance is on a competitive basis. Qualifying Officers must have a good Engineer background, which should include Company Command time, and have an outstanding performance record. Interested Officers should indicate their course preferences in the Remarks Section of DA Form 483 (Officer Assignment Preference Statement), or call the Captain's Assignment Officer in Washington, D.C. (OX3-0822). Volunteers for the Program are encouraged.

33 Engineers Win CGSC Credit For Vietnam Duty

A total of 33 Engineer officers, who served in qualifying positions in Vietnam, have been awarded constructive credit for the Command and General Staff College course under the provisions of Department of the Army Circular 351-16. All lieutenant colonels and majors on a promotion list serving in Vietnam are automatically considered for constructive credit by Branch. The basis for consideration is position held, efficiency ratings received while serving in that position, and one's total performance record. Final determination on award of constructive credit is made by a DA Board.

Plan Ahead For That Future Assignment

One of the most frustrating things for an Engineer soldier is to ask for a specific assignment and to be told that "the Engineer Branch presently has no requirements in this area"—then to learn that someone else received the same assignment a few weeks later. Unfortunately, this does happen. However, it is not that the assignment officer is trying to frustrate the soldier, but rather the nature of the personnel requisitioning system. The Engineer Branch receives requisitions to fill overseas slots approximately seven months prior to the desired reporting date, while continental United States requests are received five months prior to the report date. These requirements must be filled or canceled within a short period after the Branch receives them. An Engineer can best influence his next assignment by contacting his assignment officer early and filing a preference statement with him. Also, make sure to make an allowance for leave and travel time when computing the availability date. To receive the assignment of your choice, you should get your request in at least seven months before you are due to return from overseas and at least nine months ahead of time if you are leaving for overseas duty.

Total Professionalism

by Major Paul L. Theuer

has been the Engineer's standard for many years because his role demands it. Now, to meet the increasing challenges of the future, he must strive for an even greater degree of qualified competence in his exacting field.

The concept and value of "professionalism" is constantly before all of us both in military and civilian life. The normal interpretation includes performing the assigned task in the finest manner possible. No one will question that. It is a most creditable response, but is it "total professionalism"?

"Total professionalism" involves more than just doing a job, or maintaining one's status quo. Perhaps the best example of the absence of "total professionalism" is found in the dilemma facing space industry engineers and scientists. No one can dispute what they have accomplished since the days of Sputnik I (September 1957). They placed this country first in space. But why does the dilemma exist today? Why are technical personnel in many parts of the United States "out of employment," while some areas of engineering are actively seeking technical and engineering personnel to fill valid position vacancies?

Regardless of what we are now doing, it is considerably less than what we are trained to do, and what we are potentially capable of doing. It takes additional effort and at times a difficult effort, to keep ourselves primed to work outside of our present area of application when the need arises.

This article will attempt to analyze the current dilemma, by developing the concept of "total professionalism" and by showing that preventive measures are possible to preclude large

> *"Professionalism involves more than just doing a job, or maintaining one's status quo. . . ."*

"The military engineer must never forget his responsibility to the engineering profession . . . it is not suspended while in uniform. . . ." "Skill maintenance? . . . both the employer and the employee must assume appropriate responsibility. . . ."

scale recurrence of the problem.

The traditional dual role of the Corps of Engineers and other technically-oriented branches of the Army dictates that a level of qualified competence be attained that is comparable to its civilian counterparts. This evidence of individual competence by professional registration is as vital an ingredient for acceptance and qualification among engineers and technical personnel as acceptance by state examination is for bona fide lawyers and physicians.

The National Society of Professional Engineers (NSPE) points out that registration provides the engineer with the authority to practice engineering before the public and establishes his professional standing on the basis of legal requirements. From a military view, the full development of the "total professionalism" concept will likewise have a tremendous public relations impact on the publicity of the "volunteer" Army. The young officer must be imbued early in his career with the importance of certification through successful completion of the Engineer in Training (E.I.T.) examination and on through the registration process. The corollary is that quality performance of a professional engineer is more easily achieved in a military environment if the personnel in charge at all levels are in fact "engineer-engineers."

The Chiefs of Engineers and Civil Engineering of the three services have viewed the importance of professional registration as one of standard policy for many years. Their roles demand it. The part each service shares in the total U.S. engineering effort, both at home and abroad, demands that the military component of each project be administered by personnel displaying competence and "total professionalism."

Regardless of the trade or profession that one enjoys, his expected useful life is a function of the maintenance effort expended to keep his knowledge current. How does one do this? Is formal refresher training necessary every few years? Can it be done at home? Let's examine the question.

Skill maintainance includes any action, which yields new and current knowledge in a particular field and an awareness of the present state-of-the-art in terms of technology, hardware, and application. Skill maintenance can be accomplished through a formal education process, non-resident instruction through government or private sources, reading of technical and trade journals, membership and participation in pertinent technical societies, and the study and review of applicable manufacturers' literature. The maintenance process must be broad-based rather than concentrated in a narrow area of current employment or practice. Continuous "saleability" checks must be made by the tradesman or professional to insure that he is negotiable in more than his present area of activity. The very question of "saleability" was brought to the forefront with the recent space and aeronautical industry layoffs. A subsequent problem arose of finding employment for professional personnel who were determined to be poorly maintained tradesmen and professionals.

Here lies the problem. What can be done now to preclude another dilemma, or an extension of the current problem. Both the employer (military and civilian) and the employee must assume appropriate responsibilities. The employer must provide the facilities and the incentives for his employees to continue their education and to seek new knowledge. By doing so, he makes employment with his firm more attractive from the view of professional recruitment, while building a degree of flexibility into his internal personnel structure. Similarly, the employee must commit himself to the sacrifice of time and effort to restore and retain his "saleability," making him a more viable part of his organization.

One might ask, how does professional registration and skill maintenance contribute toward "total professionalism"? The answer is stated simply that to be more than ordinary, we must do more than the minimum required. We may be in the Army or the Navy or with a civilian consulting firm, but more important, we are part of a larger group—our profession. For our profession to make its rightful contribution to mankind (engineers have contributed a large share during the past century), we must keep ourselves current or "saleable". We must be willing to sacrifice our time and our labors. If we have a new idea we must be willing to share it with our fellows through contribution to technical journals. We are like trees in the forest, and one is not able to exist without the mutual support of the rest of the forest.

Many options are available for personnel in uniform to obtain information and preparation for certification (E.I.T.) and registration (P.E.), or to merely provide for their continued education and development. A large selection of correspondence courses are available through the non-resident instruction departments of Service Schools, or directly from national professional societies. The state and national professional societies are becoming more aware of the requirement for continuing education in their respective fields. At an increasing rate, they are expanding their offerings in the form of book-reviews, short courses and seminars, and editorial comment on the value and importance of professional registration/licensing and skill maintenance.

The military engineer must never forget that his responsibility to the engineering profession and to mankind is not suspended while he is in uniform. Instead, his military career can be enriched through professional development. His involvement in military engineering is neither accomplished alone nor in a manner which is different from his civilian counterpart. Many times, he finds himself in remote parts of the world working side-by-side with a civilian contractor engaged in the same project, and faced with the same problems which demand the same competence. To meet the challenge of the task, he must know all the aspects of his assignment, both military and engineering, and by doing this he will reflect "total professionalism" in his person and performance as a military engineer.

"Quality performance of a professional engineer is more easily achieved if personnel in charge are in fact engineer-engineers" . . .

Major Paul J. Theuer is the Commandant of Cadets, Army ROTC, at Pennsylvania State University. He is a registered Professional Engineer in the District of Columbia, and is currently a candidate for a Master of Science degree in engineering.

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Bye Bye Blackbirds

The birds are coming! The birds are coming!

This eerie warning of a well-known motion picture aptly describes the spark that ignited a conflict between elements of an engineer light equipment company and a host of obstinate blackbirds.

The setting of this epic struggle was the sleepy town of Paris, Texas, in late September 1969. Along with the community's 25,000 human inhabitants, thousands of blackbirds resided in Paris. Nesting in a large wooded area within the city, the feathered invaders were a nuisance and posed a health hazard due to the various diseases they carried.

City firemen and police, armed with shotguns, were assigned the task of eradicating the feathered pests. The tenacious birds, however, met the armed assault with aloof indifference and after a week of shooting they were as entrenched as ever. Experts then decided the only solution was to destroy the birds nesting environment. Underbrush would have to be cleared, and most of the trees would have to be removed.

The decision to destroy the bird's lair was reached while they were migrating and the clearing had to be completed prior to their return. However, to its dismay, the city had neither the equipment nor the finances to undertake such a project. The stage was now set for the entrance of the local Army Reserve unit into the conflict against the feathered intruders.

Located in Paris, the 952nd Engineer Company (light equipment) had troubles of its own. Recently reorganized as engineers, the company's men had received only limited training as engineers since its change from an ordnance unit. This problem of inexperience was magnified by the fact that the reserve unit's property provided barely enough space to park the vehicles, let alone sufficient area to operate them.

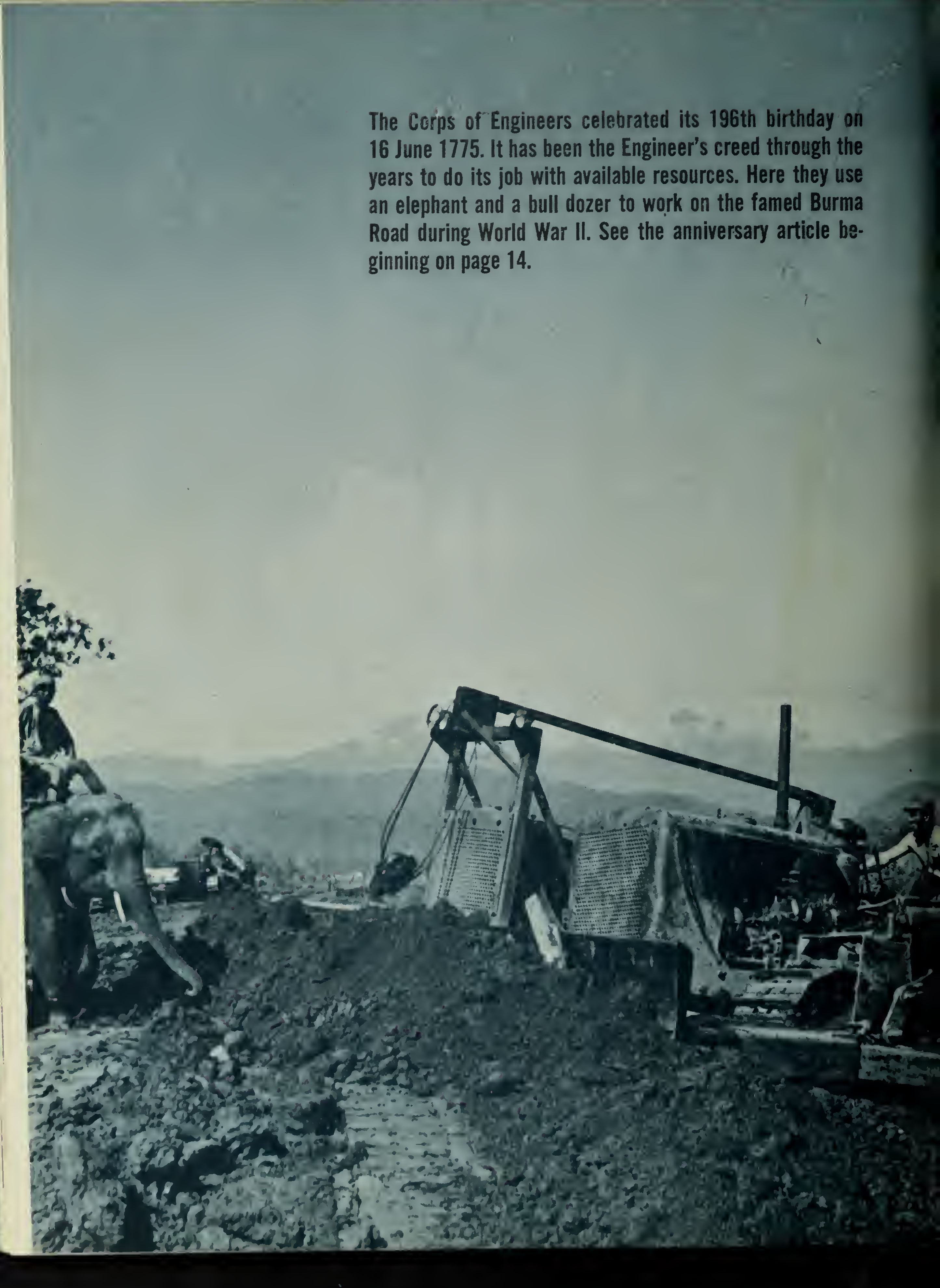
When approached by city officials, the 952nd immediately saw not only a chance to serve the community of which it was a part, but also a chance to provide its men with useful and much needed training.

Working with city officials, the company provided bulldozers, dump trucks and a bucket loader to accomplish the clearing operation. Debris was piled where the local fire department later burned it.

After four months and as many two-day training sessions, the 20 odd acres were cleared. When the blackbirds returned, they found that they had been evicted. Only charred stumps and a few larger trees remained in their once highly-wooded home.

The effort had tremendous results. The morale of the men of the 952nd soared to a new high, while they received worthwhile training. Residents of Paris who had been plagued with the pesty birds had only the highest praise for the effort expended by the unit. The city itself received a solution to what had appeared to be an unsolvable problem. And lastly, the blackbirds reluctantly found a new home.

The Corps of Engineers celebrated its 196th birthday on 16 June 1775. It has been the Engineer's creed through the years to do its job with available resources. Here they use an elephant and a bull dozer to work on the famed Burma Road during World War II. See the anniversary article beginning on page 14.



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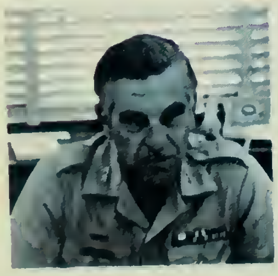

CHIEF'S BRIEFS.....

Colonel Richard Gridley, America's first Chief Engineer, was born at Boston, Massachusetts, on January 3, 1710. He was the outstanding American Military Engineer during the French and Indian War, from the Siege of Louisburg in 1745 to the fall of Quebec, which ended French rule of Canada. For his services, he was given a commission in the British Army, a grant of the Island of Magdalen, 3,000 acres of land in New Hampshire, and a life annuity. When the break with the mother country came, he declared himself for the colonies; and in the spring of 1775 was made Chief Engineer and Chief of Artillery of the New England Provincial Army, with the rank of Major General. By making this break with the Government in London, he sacrificed all his annuities and emoluments from the British Government.

On June 16, 1775, the Continental Congress authorized a Chief Engineer "at the Grand Army," and that night by lantern light, Colonel Gridley, America's first Chief Engineer, marked the lines for entrenchment for the defenses on Breed's Hill. Then, with spade in hand, he helped throw up the defenses, and in the afternoon was carried wounded from the field after having fought valiantly in the trenches. This marked Colonel Gridley as the first "pick and shovel" combat engineer in the United States Army.

The colonel was appointed Chief Engineer of the Continental Army after Washington took command in July 1775, and directed the construction of the fortifications which forced the British to evacuate Boston in March 1776. When Washington moved his Army south, Gridley remained as Chief Engineer of the New England Department to construct fortifications on the New England coast. He held that position until his retirement in 1781.

General Washington wrote that Richard Gridley was "one of the greatest engineers of the age."

Colonel Gridley died at Stoughton, Massachusetts on June 21, 1796 at the age of 86.

designed for professionals

U.S. Army Engineer School
Fort Belvoir, Virginia

Commandant
MG Robert R. Ploger

Assistant Commandant
BG Richard L. Harris

Deputy Assistant Commandant
COL William F. Hart, Jr.

Officer-in-Charge
MAJ Tommy B. King

Editor
Robert G. McClintic

Managing Editor
William T. Spriegel

Art Director
John W. Savage, Jr.

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ABOUT THE COVER

The nameless faces of the men and the machines that "clear the way" in a combat zone as envisioned by Art Director John W. Savage, Jr., illustrates the Engineer presence in Vietnam.

Pipeline

OUT OF THE BLUE

A SKYCRANE AIRLIFTS concrete to tower bases that support the steel towers which in turn will support the new roadway span on the Chesapeake Bay Bridge. In a continuing series of shuttle flights, the Skycrane lifts the prepoured concrete in four-yard buckets, and flies to a barge anchored along the individual towers. Each four-yard load weighs about 17,000 pounds. The concrete is released into a hopper on the barge and is then transferred by conveyor belt to the tower foundation and spread by work crews. U. S. Army engineers have been watching this operation with interest because normally concrete work over water is done with barges. The Skycrane method can do the job in 19 days. It would take six months to do the job under the conventional method.

NO MILITARY CONSTRUCTION FUNDS SLATED FOR SE ASIA SUPPORT IN FY 12

The Defense Department has requested a whopping $2,259.4 million in authorizations for military construction during Fiscal Year 1972 as compared with DOD requests for $1,893.3 million in FY 1970 and $2,069.1 million in FY 1971.

None of the FY 1972 money will be used for military construction in support of operations in Southeast Asia. This is the first time since the buildup began over there that DOD has requested no authorization or appropriations for military construction for that area.

Actual enactments in the two prior years totalled $1,639.7 million and $2,001.2 million, respectively.

The increase in requested FY 1972 authorizations over the amounts requested for fiscal years 1970 and 1971, is due primarily to additional emphasis on housing for both bachelor and married personnel as well as increases for pollution abatement and Reserve Forces facilities.

NEW ENGINEER LAB MOVES FROM NATICK TO FORT BELVOIR

The Earth Sciences Laboratory (ESL) has finally relocated from Natick, Massachusetts, to its new address with the U. S. Army Engineer Topographic Laboratories (ETL) at Fort Belvoir, Virginia.

ESL was officially transferred from the Army Materiel Command (AMC) to the Corps of Engineers last May but the physical move was just completed in September. The Corps of Engineers' U. S. Army Topographical Command is the parent organization of ETL.

The ESL mission is to perform research and development in the fields of environmental and geographic sciences.

BATTALION SOLVES MAJOR PROBLEM FOR SMALL TOWN

The 293rd Engineer Battalion has taken a long step toward cementing German-American friendship for the U. S. Army Engineer Command, Europe.

When the wells went dry in the small town of Odenbach near Baumholder, the citizens were faced with a major problem. The town had no water trucks and needed help quickly. It came from B Company of the 293rd.

The unit sent a water truck to the town every day until the water supply was relocated. Engineer drivers made 14 trips a day—accounting for 44,000 gallons of water—to keep the town well supplied.

Odenbach did not forget B Company. As a token of their appreciation, the citizens presented a pewter teapot to the company. In addition, all members of the unit were invited to an Odenbach festival.

ARMY TAKES HARD LOOK AT NEW "SOFT" LENS CONCEPT

Engineers who must wear eyeglasses while using optical-lens equipment may soon be wearing special "specs."

Some soldiers have broken their glasses while using surveillance devices and have suffered a double tragedy—they sustained eye damage and the Army lost some highly-skilled specialists.

To counteract this problem, the Army is looking beyond the ordinary contact lenses toward a principal called the "soft" lens.

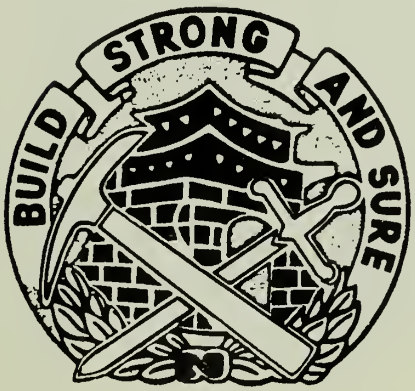
These are flexible silicone rubber lenses which appear to meet many of the required characteristics such as safety, comfort, stability and continuous wear for a minimum of five days in a military environment.

Recent studies and surveys by the Combat Developments Command indicate that some 35 percent of our soldiers wear glasses (26 percent came into the Army wearing them.)

Also listed are some 92 optical sights and devices that a soldier with glasses would have difficulty operating, or that he could handle more effectively with "soft" spectacles. Engineer equipment that Corps personnel, who wear glasses would have difficulty handling, include—plotting instruments, mechanical stereo platters and other surveying instruments, azimuth measuring devices and theodolites.

24TH ENGINEER GROUP GETS NEW CREST

Members of the 24th Engineer Group, based in Kaiserslautern, Germany, have pinned on a new insignia that significantly portrays highlights of the unit's history since its activation.



The scarlet and white colors of the insignia are, of course, the colors of the Corps of Engineers. The Korean Gate (South Gate of Seoul) and the laurel wreath commemorate the unit's combat history during the Korean War. The 24th earned two Republic of Korea Presidential Unit Citations and eight campaign awards (battle stars) for its service during that action.

The laurel, indicative of merit, together with the scarlet knot, also refers to the Meritorious Unit Commendation for Korea. The 24th Group's World War II campaign service in Europe and historic Combat Engineer mission are noted by the sword.

The pick mattock signifies the organization's subsequent and present Engineer Combat mission.

ENGINEERS LAUNCH PROGRAM TO ATTACK WATER POLLUTION

The Engineer Corps has initiated a two-pronged program aimed at cleaning up the nation's rivers and lakes.

Feasibility studies into waste-water management problems should provide some answers. Two programs, the permit program, aimed at keeping pollutants out of the water and the waste-management program, aimed at finding other ways to get rid of them.

engineer interview:

with major general Robert R. Ploger

The fall issue of **the engineer** *magazine is highlighting Engineer accomplishments in Vietnam and on many of the following pages, hopefully, provides an in-depth account of the trials and successes since the buildup began in 1965.*

To get answers to some of the more probing questions, **engineer** *Editor Bob McClintic asked an expert on such matters.*

That expert, Major General Robert R. Ploger, Commanding General of the U. S. Army Engineer Center and Fort Belvoir, and Commandant of the Engineer School, Fort Belvoir, Virginia, has written a book about the exploits of "Army Engineers in Vietnam—1965-1970."

A veteran combat engineer with 32 years in the Corps, General Ploger commanded both the 18th Engineer Brigade (the first major engineer combat unit in Vietnam) and the U. S. Army Engineer Command during a two-year tour in that country.

McClintic took the following impressions away from the interview:

"General Ploger's headquarters offices are located at Flagler Hall, an old brick mansion that nestles midst gigantic oak trees adjacent to Fort Belvoir's spacious parade ground. Two bronze cannons, their glitter turned to a greenish-blue patina by time and natural oxidation, stand majestically at the entrance.

"At first glance, General Ploger looks like the typical large corporation president, or a banker, or a flag officer. He is the latter.

"He comes across in conversation as a true gentleman with a quick and agile mind. His great compassion for his troops is readily apparent—especially for the private, the noncommissioned officer, and the young officer.

"It is said that the mark of a soldier can be weighed by his combat decorations, his various badges, the mileage he has covered throughout the world, and the wars he has fought.

"It is also said that one need look no further than a man's eyes to find the mark. In General Ploger's case, the mettle shows through in the wisdom and deep comprehension reflected in his piercing, unwavering eyes. Even if he were incognito and in mufti, the general would impress you in a direct confrontation as someone who has been there and back and would like to go back again."

Commissioned in the Corps of Engineers in 1939 following graduation from the U. S. Military Academy at West Point, General Ploger's career has had many highlights.

"We must use every man . . ."

". . . must use every machine . . ."

"and every moment to advantage."

During World War II, he made the Omaha Beach landing as engineer advisor to the commander of the 29th Infantry Division, and later led the 121st Engineer Combat Battalion through the Normandy, Northern France and Germany campaigns. When the buildup in Vietnam began in 1965, General Ploger was tapped to command the 18th Engineer Brigade.

He later became the CG of the U. S. Army Engineer Command and Senior Advisor to the Chief of Engineers of the Republic of Vietnam. The general has served in many other command assignments —Army Division Engineer for New England, Topographer of the Army, and Director of Military Engineering in the Office of the Chief of Engineers.

The general has two masters degrees—one from Cornell University in Engineering, and the other from George Washington University in Business Administration. He also attended the Industrial College of the Armed Forces and after completing the resident course, served for three years on the staff and faculty as a lecturer with a National Security Seminar team of the college.

General Ploger wears three hats at Fort Belvoir and, consequently, has three fundamental missions. One, he commands all of the units that are assigned to him at Fort Belvoir. Two, as Commandant of he Engineer School, he manages a highly-technical institution involved n providing future military engineers with the professional and technical expertise necessary to meet all engineer responsibilities in the fuure Army. Three, as post commander he provides logistics and administrative support for some 30 organizations that are located at Fort Belvoir but are not assigned to he Engineer Center.

General Ploger sums up his Fort Belvoir assignment most appropriately: "With the preparations we are making, engineers of the future Army will be abreast of every advance and ready once again to respond as professionals."

ENGR: GENERAL PLOGER, YOU ORGANIZED THE ENGINEER COMMAND IN VIETNAM AND HAVE WATCHED IT GROW FROM INFANT TO MAN-SIZE PROPORTIONS. YOU HAVE BEEN VITALLY INVOLVED IN ITS MANY AND VARIED ACCOMPLISHMENTS. WOULD YOU COMMENT ON THE COMMAND ACCOMPLISHMENTS?

PLOGER: I started out when an engineer presence already existed in Vietnam. There were some 5,000 officers and men already on the ground when I got there but I saw the Engineer Command grow to a strength of about 30,000. The accomplishments ranged across the full scope of engineering—from such simple things as preparing terrain analysis for tactical commanders to the erection of highly complex structures. I think the real accomplishment is measured in the statement of many tactical commanders over there who said that no operation, tactical or otherwise, suffered or failed to be performed because of any shortcoming on the part of engineering input.

ENGR: WOULD YOU COMMENT ON THE COMMAND'S PROBLEMS SINCE ITS ESTABLISHMENT IN LATE 1965?

PLOGER: I would say the problems were mostly associated with making the environment adaptable; amenable to our interests. We had a few organization problems such as finding people with the right skills and getting adequate supply support. There was a shortage of engineer and construction materials, and spare parts. I suppose the most serious problem related to spare parts support—keeping the equipment functioning. Another major problem that was unique to South Vietnam was the necessity to keep book on every bit of construction that we performed. We had to set up a cost accounting program to insure that we were not violating congressional appropriations legislation in terms of financial construction. We were also trying to find solutions to things like dust control, and counter-mine warfare.

ENGR: WHAT HAS BEEN THE MAJOR MISSION OF THE ARMY ENGINEER IN VIETNAM?

PLOGER: The major mission has been to insure that the engineer expertise is provided to enhance the success of tactical operations. This goes beyond direct application to the tactical situation because, in order for the tactical operation to work, you must worry about equipment, spare parts, weapons, maintenance, ammunition and petroleum reaching the users where and when they need it. The engineer provides a logistics framework structure, facility support, roads, airfields, and ammunition storage areas. We provide these facilities all the way from the shoreline to a battle site for the tactical commander.

ENGR: WILL THE ENGINEER MISSION CHANGE TO MATCH THE CHANGE IN ITS PERSONNEL STRENGTH IN VIETNAM?

PLOGER: The mission will not change. It is, of course, set forth in Army Regulations. It is further defined locally to meet a particular situation. There will be less involvement of U. S. engineers in combat operations because the elements they support are being removed from this activity. We are now pointed more toward supporting the Vietnamese—through training, education, example, and advisors. Our mission is not changing but the proportion of time devoted to the different aspects will unquestionably change—as it has over any period of time. For instance, in the very early days of our period in Vietnam, a tremendous proportion of our time was devoted to the development of the bases from which U. S. forces could launch attacks. Subsequently, this changed and more and more engineer effort went into the support of tactical formations in the field.

ENGR: AS A VETERAN COMBAT ENGINEER, DO YOU THINK THE WAR IN VIETNAM HAS BEEN MORE TRYING FOR ENGINEERS THAN THE TWO MOST PREVIOUS WARS—WWII AND KOREA?

PLOGER: I think Vietnam presented more of a challenge. This might not be universally true. We had people in the Southwest Pacific and in the Burma, China-India area who endured the same kind of weather that is characteristic to Vietnam. But there were new challenges. There was a demand for greater competence in the construction business than was true in the past. We combat engineers from combat battalions were involved in constructing some rather sophisticated facilities. For example, at An Khe, the 70th Engineer Combat Battalion built an ice plant. Although prefabricated, it was still a fairly complicated structure. Another challenge to those engineers who lacked experience in the tropics stemmed from the intense rains and heavy runoff characteristic of Vietnam. Engineers had to worry about drainage every place over there. You can get up to five to seven inches of rain a day nearly anywhere in the country. Another serious challenge was the cost accounting program. This was a very tough problem to address in a combat circumstance. But we did address it and did a very fine job of accounting for construction. Both combat and construction battalions had to keep cost records on whatever they built. This is something that was not required in previous military tactical operations. We used to be able to draw supplies to do whatever construction was required with little regard to its intended use. This time we had to account for how much went to Army military construction. How much went to operations and maintenance for the Army? How much was chargeable to other purposes? This was a whole new problem area that was unique to tactical operations in South Vietnam. I would hope we could find some shortcuts if we should ever have to repeat this kind of operation outside the United States. Engineers are not using their skills to best advantage when they are required to be accountants. This is not their area of expertise. If we need accountants, perhaps we should have some people so qualified, come in and handle that side of the program, and let the engineers go on with their own special skills.

ENGR: WHAT DID YOU THINK OF THE ENGINEER SOLDIER AND OFFICER IN VIETNAM? WERE THEY AS GOOD AS THEIR COUNTERPARTS IN PREVIOUS WARS WHERE YOU HAVE SEEN ACTION?

PLOGER: They were the best ever. I placed trust and confidence in both the officer and enlisted man working on engineering items in South Vietnam. They responded with enthusiasm and never let me down. They had a staggering task and yet they handled the job with characteristic aggressiveness. They did not complain about working 10 to 12 hours a day, seven days a week. Work was the byword. I always felt that the engineer soldier and officer in South Vietnam worked more diligently, harder, and longer hours than any other element of the military command. I agree that the engineer's job is probably more interesting. In any event, the response was universally tremendous.

ENGR: DID THIS WAR REQUIRE MORE SOPHISTICATED EQUIPMENT TO GET THE JOB DONE THAN WWII AND KOREA?

PLOGER: Yes, I would say it did. Of course, one could do most engineer field tasks with shovels and manpower. The more sophisticated equipment we received over there, made it possible for us to do more, faster and better. We received larger trucks for highway construction, pneumatic drills for rock quarry work, and new well-drilling equipment. During WWII, we used PSP —Pierced Steel Plank for our airfields. We needed something better than that in Vietnam for the more sophisticated military aircraft of today. Thanks to development efforts back in the States, we were able to use Solid Steel Plank, SSP, and two forms of aluminum matting for runways.

ENGR: WHAT WERE SOME OF THE MORE IMPORTANT LESSONS MILITARY ENGINEERS LEARNED FROM THE VIETNAM WAR?

PLOGER: Probably the most important single lesson is the recognition of the need for using every man, machine, and moment to advantage. One must do earth work even when it is raining. You must find ways to build and to move and mold earth in spite of the weather. A prime example of this is reflected in the building of highways in the Delta. We took a technique which had been used in the States, expanded it, and improved upon it to construct roads of clay using lime as a stabilizing material. I was also personally involved with trying to build an airfield at Long Thanh, where in spite of frequent rains, we had to build a four-thousand-foot runway in a relatively short period of time. Yet, we could expect some rainfall every day. Fortunately, even in a monsoon period you get some sunshine between the rain storms. We developed methods to keep the ground covered with some T-17, a rubberized membrane. When the rain started falling, we would cover what was being worked on and as soon as the rain stopped, uncover it and begin working again. We found it possible to work in some areas even during the course of the rain. If the rain does not get so heavy that your wheels are bogged down, you can continue moving. This, I think was a major technical advance. There were a number of others involving airfield construction. The combat battalions, in particular, got into this one. The air mobile concept of engineer support was another major innovation. It has proven out very well in South Vietnam. We have developed good systems for supporting air mobile operations. The line of communication development was not really something new. Wherever engineers go, we are in the road building business. Dust control systems, revetment systems for protection of facilities, protection of bridging against sabotage, against interference by enemy forces, were the principle things we had to think about in that respect. You can not build roads in that country without including these programs in your overall plan.

ENGR: HOW DO THESE LESSONS RELATE TO THE PROPOSAL FOR REVAMPING THE CONSTRUCTION BATTALION?

PLOGER: The school study on the construction battalion resulted from a Chief of Engineer's Board which was looking over our organization for construction. Based upon the experience in Vietnam where construction has been so extensive, the Board came up with a system of organization that would sort of parallel the way a contractor operates in this country. A major contractor has his various crafts operating under different management setups. This is the most efficient way to perform for a major construction operation. Certainly a contractor would not organize in that manner otherwise, because he is working to make money. So, why don't we do the same thing in our construction battalion? Why don't we organize according to skills and put all the electricians in one element, all the carpenters in another, and all of our equipment in another? This way, when you need a particular skill or craft on one job, you call on that element of command. A lot depends on the size of the jobs. An alternate proposal, then, is instead of using a battalion organized as a contractor, we would use a company organized as a contractor. The counter-proposal to the Board's was to use the company as the base, as a contractor, but distribute these various skills so that each company has the same skills apportioned evenly. The battalion organization where Company A might have all the carpenters; Company B might have electricians and plumbers; Company C might have something else, and Company D might have all the equipment; would conform to a larger contractor. The question as to which proposal is right is partly answered by knowing how big the jobs are you are going to be handling. Is one job going to absorb a complete battalion in one location? Or is it going to absorb one company in one location with the others elsewhere—at three other sites? Then you would need four companies; each capable of doing the same thing. Another, almost philosophical question, is—should the Army seek to operate like a contractor? I tend to feel we should not, because in the military the incentive for performance by a construction organization is not measurable in dollars. It is measurable in lives; it is measurable in responsiveness. Dollars must be given secondary consideration; whereas for a contractor, it is the principal factor. We are trying to save lives and we do that by exercising very tight control over our soldiers. The tighter control comes about in the smaller organizations with clear-cut near-continuous lines of command —with parallel lines of command and operational control.

ABOUT THE USE OF THE CIVILIAN CONSTRUCTION OUTFITS IN VIETNAM? THEY HAVE BEEN DOING A JOB OVER THERE AROUND A COMBAT SITUATION WHERE A HOT WAR ACTUALLY EXISTS.

PLOGER: If we can pay money enough to have civilians work in a combat situation, it is fine. They have made major contributions in South Vietnam, even in near-combat situations. In fact, this is one way in which we tried to divide up the work. Where the situation requires people with weapons to guard the workmen, we have tried to use our troops. Where there is no imminent danger to the workman, the contractor should and can work to the advantage of everyone. Any contractor will have difficulty hiring people if they are going to become shooting targets while at work. If these people are fired upon, they scatter—and are rather slow to return. If repeated, a point is soon reached where they do not produce at all. This is not the right place for a contractor to operate, but I certainly would emphasize that in Vietnam they did perform a major service. They filled a role which we were not prepared to replace.

ENGR: COULD OUR RESERVE CONSTRUCTION BATTALIONS HAVE DONE THE CIVILIAN CONTRACTORS JOB IN VIETNAM IF THEY HAD BEEN CALLED UP? WOULD THIS HAVE SAVED MONEY IN THE LONG RUN?

PLOGER: If we had called up the Reserves, yes, they could have done the job. They probably could have done everything because our Reserve construction battalions have the same kind of skills you would find in a contractor's outfit. So that could have been done but military manpower is more expensive than civilian manpower. A contractor does not have to worry about training his people on military aspects, tactics, and all this sort of thing. This is not part of his business. He does not particularly care whether his people wear dungarees, undershirts, or shirts at all. He is concerned about their health and safety. But there is a difference between training and equipping a work force and offering them steady employment. A contractor can hire people for one job. When they are no longer needed, they are off the payroll. A contractor does not have to carry workers over a long period of time when they are not doing something constructive. These things all tend to make the military man more expensive to the taxpayer than the civilian workman. After all, when you pay for a soldier, you are paying for a lot more than a construction worker. You are paying for much more than just construction ability.

ENGR: DURING WWII, ENGINEER SOLDIERS LAID DOWN THEIR PICKS AND SHOVELS, GRABBED A WEAPON AND FOUGHT AS INFANTRYMEN, ON OCCASION. HAS THIS ALSO BEEN THE CASE IN VIETNAM?

PLOGER: Yes, I guess the most frequent brushes with the enemy by our engineers were in connection with ambushes. Units were hit from time to time from ambush. This meant they had to always be ready for anything. Our troops took a heavy toll of the enemy that tried to ambush them.

ENGR: NOW THAT THE WAR IN VIETNAM IS WINDING DOWN, WILL THE ENGINEERS PLAY A MAJOR ROLE IN THE RETROGRADE OF SUPPLIES AND EQUIPMENT FROM THAT COUNTRY?

PLOGER: This is principally a logistics operation. Engineers are involved but I suspect that there will be few items brought back by the engineers. South Vietnam needs most of the bridging and other construction materials and equipment to carry on what we started. We are involved in making sure that the Vietnamese can continue with the construction modernization of the engineering base in South Vietnam. The LOC (lines of communication) program, which in lay terms means road network, has been a major contribution to the economy, the cultural development, social development, and political development of South Vietnam.

ENGR: WHAT CAREER ADVICE CAN YOU PASS ON TO THE YOUNGER ENGINEER OFFICERS AND ENLISTED PERSONNEL RETURNING TO NEW ASSIGNMENTS FROM VIETNAM?

PLOGER: I would urge each of them to commit their experiences to writing. Secondly, I would urge them to seek to widen the value of their experience. One of the shortcomings of many people returning from Vietnam is that they saw a little piece of the country and many of them think that their little part is just like every other little part. mate, in the types of works and in the types of organizational relationships across the country. So, they should seek to exchange ideas with their peers and subordinates and those superiors that remain around. They should not accept observed practices as absolute. They are not absolutes. They are activities relating to a particular environment which may not apply in the next location. I would say to each of them—capitalize on that experience to the maximum degree, work to improve their education, and learn through exposure to the different experiences of others. These things will make them more valuable to the Army and to the country in the future.

CLEARING THE WAY

ROBERT G. McCLINTIC
Editor—the engineer

is name was Robert E. Knadle.

There was little to set him apart from the aver-ige young man in mainstream U.S.A. except that ie was a second lieutenant in the Corps of En-ineers.

Even after he was ordered to Vietnam, there vas nothing to distinguish Lieutenant Knadle rom hundreds of other young officers over there loing their jobs as platoon leaders.

But, as things turned out, Lieutenant Knadle vas quite different from many of his contempor-ries. He had a date with destiny. It cost him his ife. It also put his name on this country's records s a winner of the nation's second highest combat lecoration—the Distinguished Service Cross.

This is what happened: While enroute to his ase camp by jeep from an operation near Phu Li Bridge on October 9, 1967, Lieutenant Knadle and his squad were ambushed by a numerically superior Viet Cong force firing automatic weapons and grenades from both sides of the road. The lieutenant was wounded and his vehicle was disabled by the barrage but he directed his men to defensive positions while remaining in the open near the jeep to radio for reinforcements and medical evacuation. Disregarding his own safety, the lieutenant maintained radio contact with friendly forces until he was seriously wounded by an enemy grenade. Even then, he refused aid and led his men against an enemy attack. Although he was mortally wounded during the fire fight, Lieutenant Knadle's actions inspired the squad members to continue fighting until reinforcements arrived and defeated the hostile force.

Highway 19 is surfaced with asphalt.

Grader is used to spread and level lime.

Engineer-built base camp post exchange.

Saigon's 100-acre port complex.

This is but one example of engineer determination and sheer guts against a crafty enemy. There are hundreds of others.

Heroics, of course, was not the big engineer story in Vietnam. Theirs was an untold story of flexibility which enabled them to get the job done in the early going with little more than determination and good old American ingenuity.

When the buildup began in Vietnam, the engineers were faced with challenges they had never had to cope with in previous wars. There were old roads, dense jungles and the new air mobility concept that introduced the helicopter in varied roles to an elusive enemy.

Engineers rebuilt the roads, cleared the jungles with the "Romeplow" and the LeTourneau tree crusher, and surfaced the airfields and heliports with a new type of landing mat and a waterproof membrane that can control dust swirls caused by propellers and rotor blades.

Also introduced for the first time in military history was the DeLong pier—a dock that can be towed from one harbor to another to berth deep-draft cargo ships.

These are only some of the major highlights of the story but what about the rest? Engineer operations are usually back page filler but if it were not for their unexciting projects the combat job in Vietnam could not be accomplished.

Steel and concrete bridges replace low load capacity bridges.

To get true insight into the total engineer picture over there, we must look at all of the innovations and methods our people have employed to make their mission a success in a complicated environment.

First off, we should set the stage with a geography lesson. South Vietnam is crescent-shaped and is perched on the southeastern edge of the Indochina peninsula. The arc formed by South Vietnam is about 700-miles-long and ranges in width from 40 miles in the north to 120 miles in the south. The country is bordered on the north by Communist Vietnam and on the west by Laos and Cambodia. The South China Sea is on the east and the Gulf of Thailand is on the Southwest. South Vietnam comprises about 66,000 square miles; has a coastline of more than 1,500 miles, and a population of about 16-million people.

Vietnam's climate is tropical monsoonal with a wet season in most sections during the southwest monsoon (from mid-May to early October), and a relatively dry season during the northeast monsoon (from early November to mid-March). Most of the northern two-thirds of the country consists of forested mountains and hills characterized by steep slopes, sharp crests, and narrow valleys. Most peaks are from 2,000 to 6,000 feet above

Daily mine sweep.

Forward fire base construction.

sea level. Few exceed 8,000 feet. In the west central part of the country, the mountains give way to rolling plains 1,000 to 3,000 feet above sea level while the southern third consists primarily of the vast delta of the Mekong River. The Mekong Delta is a flat, low lying rice growing plain, mostly flooded from early June through December. Elevations throughout the Delta are generally less than 10 feet above sea level and dense networks of canals and ditchs connect the wide, deep, and meandering distributaries of the major rivers.

The mountains and hills of the north and west are covered with a dense jungle growth that prohibits cross country vehicle movement and serves as cover for guerilla operations. The silty soils of the delta are rich in clay and organic material and present many problems for building foundations, roads, and airfields.

On top of all this, there is the dust. It exists almost everywhere when it is not raining or muddy. The dust acts as an abrasive when caught up in the working parts of equipment. It also presents a morale problem because it sifts into the clothing, food, and living quarters of our troops.

This, then, was the terrain and climatic situation our engineers faced when the buildup began in 1965. When the engineers got there they were in immediate trouble because of the poor roads in South Vietnam. The total highway system consists of about 12,000 miles of roads; one-fourth of which had a bituminous-treated surface. Only primary roads had sections permitting two-way traffic.

Through hard work and perseverance, the Engineer Command, Vietnam, rebuilt the roads and did many more things than can be told here. The Command, which consists of four Engineer groups and three Engineer districts (also two brigades until recently), expends nearly 50 percent of its effort on combat and operational support and the rest on base and road construction.

Here are some of the Command's major accomplishments during the past five and one-half years in Vietnam:

- *Item*—Engineers developed deep draft ports at Danang, Qui Nhon, Vung Ro Bay, Cam Ranh Bay, Saigon, and Vung Tau to accommodate the some 600,000 tons of incoming cargo per month.
- *Item*—Engineers began work in June 1965 to construct a port and logistics facility at Qui Nhon. How to do it was the problem. Qui Nhon was an overcrowded coastal town that reached almost to the shoreline. Little real estate was available close to the harbor for building a port or depot. No facilities existed for handling deep draft ships and the harbor channel was too shallow to accommodate them. The construction of the port included the extension of the peninsula with about 45,000 cubic yards of fill to create a useable area of 220,000 square feet for off-loading and lighterage. The mission was to build a port and harbor capable of handling deep draft ships. The Army Engineers' large sea-going Civil Works dredge, the Davison, was withdrawn from its operations in the Portland, Oregon, area and sent to Vietnam. It was brought in to deepen the two-mile-long approach channel to the Qui Nhon port area. The turning basin was deepened by a hydraulic dredge. A deep draft port was then constructed using hydraulic fill providing a large surfaced transit storage area and causeways with paved roads. Today, the port of Qui Nhon has four deep draft berthing spaces at the DeLong pier and transit storage space along the causeways.
- *Item*. Engineers have constructed four deep draft piers at Cam Ranh Bay which is one of the best natural deep water harbors in Southeast Asia.

They also built a gigantic depot there.

- *Item.* Engineer soldiers built the community facilities in the base camps. These facilities included the post exchanges, the chapels, and the libraries.
- *Item.* Engineer troops and civilian contractors have drilled hundreds of water wells at the various camps throughout Vietnam. In developing the wells, they had to construct water tanks and install treatment facilities.
- *Item.* Engineers built many of the Army hospital facilities in Vietnam. They also constructed many of the field hospitals and convalescent centers.
- *Item.* Engineers have established quarries and crushing units throughout the country that produce about one-third of a million cubic yards of crushed rock each month.
- *Item.* Engineers have built many steel and concrete bridges as replacements for low load capacity bridges. Some of the longer bridges represent significant engineering achievements.
- *Item.* Engineers helped construct the many airfields throughout the country. They have also built numerous aircraft support facilities such as control towers, protective parking revetments for rotary wing and fixed wing aircraft, and maintenance hangars.
- *Item.* Engineers have been applying dust palliatives to roads, airfields, and base camp areas daily for the past few years. They use an asphalt emulsion known as peneprime to suppress the dust which has caused serious maintenance problems with our complex equipment.

Of course the primary mission of the Army Engineer in Vietnam is to support the combat soldier. As in World War II and Korea, he has been doing just that.

Engineer soldiers often accompany Infantry assault waves or sweeps. After being "choppered" to a jungle clearing, Engineer troops cut helicopter landing zones with chain saws and demolitions and help construct defensive positions.

The jungle has been a major problem because it is here that the enemy has had some sanctuary. So, the U. S. Army developed a new concept in jungle warfare. An Engineer land clearing team outfitted with 30 tractors with special tree cutting blades can mow down all vegetation in any section of the jungle in a matter of hours. To date, more than three-fourths of a million acres of jungle have been cleared by the special Engineer teams.

Constructing forward fire bases is another job that has been set aside for the Army Engineers. There are a number of ways engineers complete this mission. Some engineer units have an air mobile capability. So they prefabricate smaller bunkers, guard towers, and other structures in the rear areas and airlift them to the forward fire bases. The larger bunkers are constructed on-site. Engineers also provide this type of combat support by constructing artillery fire support bases.

The roads are still the principal means for the movement of supplies and equipment even though both the helicopter and new transport aircraft are used extensively for this type of thing. To keep the access roads free from land mines and booby traps, Engineer troops must sweep hundreds of kilometers each day. They do almost all of it by hand because it is the most reliable. This method is also the most dangerous. Mine rollers and mine dogs have been used to detect mines with only partial success.

The scope of the U. S. Army Engineer Command, Vietnam, is tremendous. During a one-year period, the Command cleared more than 100,000 acres of jungle, paved some two-million square yards of airfield surface, moved more than 20-million tons of earth and fill, built more than 150 miles of road and logged more than seven-million hours in the repair and the service of equipment. The Command also rebuilt and graded the north-south coastal highway, erected troop housing, storage depots and other facilities totaling over 10 million square feet, and completed four miles of tactical bridging.

Army Engineers have done an outstanding job in a difficult land during a difficult war. They have been the builders of the landing pads and the runways for our aircraft. They have built new roads and rebuilt old ones. They have drilled and blasted through rock banks to open passes for our troops. They have mapped that country to provide precise information in support of Army artillery, hydrography and navigation, and the location of Air Force and Navy radar sites. They have carved out an engineering record that is unparalleled in the annals of warfare.

Our engineers have learned their lessons the hard way and well in Vietnam. But they have forged ahead through know-how, sophisticated new equipment and modern management techniques. The knowledge they have acquired over the years in Vietnam will be the hub of the programs military engineers must use in the Seventies—to help provide for the modernized Army of tomorrow.

BASE DEVELOPMENT

Major General Curtis Chapman

A new system Engineers will use as part of the total planning picture.

ARMY ENGINEERS have long recognized that base development planning is an integral part of the total planning system.

Base development includes the advance planning and all subsequent actions necessary to provide, in a timely manner, facilities in the quantities, types, and proper locations to enable military forces to initiate and sustain the operations directed in joint contingency operations plans.

Lessons learned in Vietnam have shown that there is a pressing need to devise and use a base development planning and execution system which will be responsive to the needs of the field commander. Such a system is evolving now.

Our poor experience in Vietnam has sparked the Joint Chiefs of Staff (JCS) decision to ensure that the commanders of unified commands assume direction of base development planning and execution rather than following the previous procedure of accepting separate plans prepared by the Service components.

The JCS decision evolved over several years, with certain significant milestones. Perhaps the earliest information that influenced the JCS decision was re-

Engineer troops buiding hospital at Qui Nhon in 1966.

Building forms for foundations.

Storage Warehouses.

Base Barber Shop.

leased in May 1967 in a publication from the Military Assistance Command, Vietnam (MACV) titled "Observations." It was a compilation of observations, suggestions, and recommendations from the Director of Construction of MACV, the three components commanders, the Officer-in-Charge of Construction (OICC), and the cost-plus-award fee Contractor.

To correct the weakness of the base development system documented in "Observations," the JCS initiated a comprehensive study of the entire planning system in November 1967. They established the Joint Military Construction Study Group which examined every facet of the system and made recommendations in key areas. These recommendations brought about the JCS decision for unified commanders to assume responsibility for base development planning.

In 1968, the Deputy Assistant Secretary of Defense for Properties and Installations published another important document, "Base Development for Contingency Operations," which provided information, policies, and guidelines to assist in planning and executing base development in overseas areas of contingency operations.

To further coordinate the planning process, the JCS established a Joint Staff-Service Construction Board for Contingency Operations in 1969. This board has been collecting, developing and proposing construction standards and planning factors for JCS approval and implementation in contingency operations. The board also publishes a joint catalog of facility components to disseminate information among the Services.

The most recent evaluation of base development in support of the Vietnam effort was completed by the Joint Logistics Review Board (JLRB). In November 1970, the JLRB presented its report on base development in Southeast Asia. The report's recommendations have helped solve significant problems in base development planning and execution.

Within the Army Staff, the Deputy Chief of Staff for Logistics (DCSLOG) organized a Base Development Board which identifies staff responsibilities to ensure that future Army support in contingency Operations is both effective and responsible. And early this year, a final draft of FM 31-82 "Base Development" was prepared and distributed by the U. S. Army Combat Developments Command.

Since the fall of 1968, the Chief of Engineers has supported the Army component commands by drafting their base development plans. Due to this experience and requests from component commanders, a decision was made for the Chief of Engineers to operate an Army Base Development Planning Office, consisting of trained planners assisted by computerized techniques who can provide expert planning support for the Army components worldwide.

The various boards and study groups have provided still other lessons from our experience in Vietnam. Some of the more important lessons and their implications are—

- Facility Components. These components are pre-engineered and prefabricated items (or families of items) of facilities that are required to support contingency operations. They are easily transportable, easily assembled and may be relocatable. The Army catalogues these items in the Army Facility Components System (AFCS), formerly the Engineer Functional Components System, which also identifies most common-use facilities necessary to support troop units, regardless of mission. In addition to construction planning served by the former system, an updated AFCS will provide logistics planners with data for base development planning and operations planners with information for development of project stocks. It will also accommodate phased development of military complexes through application of space criteria and standards of construction. Recently, the Chief of Engineers, Lieutenant General Frederick J. Clarke, has applied renewed emphasis to AFCS management by establishing a special office within his Directorate of Military Engineering.
- Construction Capability. The construction required as a result of the 1965 decision to build up forces in Southeast Asia generated the need for far more troop construction units than existed in the active Army. Since the DOD planning policy was to rely on the Reserve Components, the Army's mobilization concept emphasized combat engineer battalions in the active establishment with the bulk of the construction battalions in the National Guard and Reserves. Because of the decision not to call up Reserve and National Guard units, the initial Army construction capability was severely limited. Significant reliance had to be placed on contractor capabilities while all Services accelerated their programs to increase the number of construction units in active forces. The contractor had inherent limitations, such as being tailored for specific endeavors, needing considerable time to mobilize, requiring comparatively extensive sustaining base facilities, and being employed only at relatively secure sites.
- Responsive Funding. Pin-pointing of funds to finance construction in support of contingencies has always been a problem. Construction support of the Korean War was funded primarily from Operations and Maintenance (O&M) appropriations. This is appropriate in a declared war; however, in a cold war or

Bunker Construction.

Laying an airfield landing strip.

A-Frame Chapel.

Deep Water Port Facility.

a contingency situation, there is no legal authority for using O&M to construct other than very minor facilities. For any major construction effort during a contingency, Congress must appropriate military construction funds. It was learned in Vietnam that to provide the necessary flexibility for changing situations, requirements must be programmed on an area-wide, gross facilities basis for each Service, with provisions for easy adjustment by MACV between various types of facilities. This lump sum procedure was used for all worldwide construction which was in direct support of the Southeast Asia operation. Since the funding was not tied to individual projects, adequate flexibility to meet changing requirements was provided for the in-country commander, with controls on major deviations retained in the Office of the Secretary of Defense.

- Centralized Direction of Construction. This problem was most difficult to solve for Vietnam, and the solution still is not completely accepted by all. Realization of the value of having centralized authority to direct and control all DOD construction commands and agencies (both military and civilian), except for those elements organic to major combat units, is one of the most valuable lessons of the Southeast Asia conflict. It is essential that all requirements be considered as a single integrated program. The execution must be placed under centralized control and direction at the joint level in-country. This arrangement is necessary to establish priorities in accordance with the desires of the unified commander and to allocate resources properly. The elimination of competition and duplication between Services, the application of areawide standards and criteria, the continuing coordination of all construction agencies, and the development of meaningful management information are other desirable characteristics of this "construction boss" concept.

The major construction problems identified in Vietnam have been analyzed, and positive steps have been initiated to avoid or minimize their repetition in future operations. These steps are expected to be reflected in a positive, comprehensive systems approach to base development planning for contingency operations. ⊖

Major General Curtis Chapman is the Deputy Commanding General of the Combat Developments Command at Fort Belvoir, Virginia. Prior to assuming his present post, the general was the Director of Military Engineering for the Corps of Engineers. A veteran of two wars, he served in the Pacific during WWII with the 186th Engineer General Service Regiment. Later, he was the Commanding General of the 20th Engineer Brigade in Vietnam, and then Division Engineer for the Army Engineer Division, Pacific Ocean.

AN OVERVIEW OF THE CONSTRUCTION PROGRAM IN VIETNAM

Lieutenant General Carroll H. Dunn

COMBAT ALWAYS PRESENTS a multitude of difficult problems. When the Vietnam War began escalating in 1965, our Engineer units were faced with a question—how to perform major construction in the middle of a combat conflict?

The answer was clear. We did not have enough experienced Engineer units in the active Army to handle the major building program that was required to accomplish our mission.

So, for the first time in U. S. combat history, contractors and civilian workmen assumed a major construction role in an active Theater of Operations.

There are no contingencies to cope with the enormity of the construction problem in the early planning. It was simply a situation where prior planning had not prepared for the massive buildup that was to come.

Before mid-1965, when the first U. S. Engineer units arrived in Vietnam, the only American construction capability there was a small civilian force under contract to the Navy. During this period, the Navy's Bureau of Yards and Docks, now the Naval Facilities Engineering Command (NAVFAC), and the Army Corps of Engineers shared worldwide responsibility for military construction.

This responsibility was limited to contract work and did not include construction by troops. Southeast Asia was among the areas assigned to the Navy. As Department of Defense contract construction agent, NAVFAC had an Officer in Charge of Construction (OICC) for Southeast Asia with headquarters in Bangkok, Thailand, and a branch office in Saigon. In July 1965 the Navy divided the area by creating the position OICC, Republic of Vietnam (RVN).

During the military buildup in Vietnam, engineer and construction forces received high priority for mobilization and deployment. With the coming of contingents of Army Engineers, Navy Seabees, Marine Corps Engineers, Air Force Prime Beef and Red Horse units, and civilian contractors, U. S. construction strength in RVN mounted rapidly. Vietnamese Army Engineers and engineer troops of other Free World allies handled some of the construction for their own forces which helped further the overall effort.

In February 1966, the Directorate of Construction was established in the Military Assistance Command, Vietnam (MACV), to provide centralized management of the U. S. program and I was named its first Director. It was my duty to make sure that the construction effort was responsive to tactical needs and priorities.

I had to hold construction to minimum essential requirements and enforce the most austere standards consistent with operational needs and tactical objectives. Embracing ports, airfields, storage areas, ammunition dumps, housing, bridges, roads, and other conventional facilities, the construction program was probably the largest concentrated effort of its kind in history. Pressure for speed was unremitting and conditions were adverse.

Civilian contractors were a mainstay of the building

Airfield construction.

Roadway maintenance.

Subgrade preparation.

program. Without their contribution many more troops would have been required to do the job.

Our engineers were confronted with many obstacles. For instance, the tropical climate, with its monsoon rains and enervating heat, imposed severe handicaps on constructors. Few building materials, either natural or manufactured, were available locally. The country's extensive stands of timber were in Viet Cong hands, as were many sources of aggregates. Saigon was the only deep-draft port. Roads, most of them primitive, were interdicted by the enemy. Cargoes had to move in coastal vessels or by air. The supply line to the Continental United States stretched 10,000 miles. Native labor was largely unskilled.

Another thing that complicated the entire construction program was the use of essentially peacetime funding methods in a war situation. Initially, requests were itemized and had to make their way through bureaucratic channels—the Department of the Army or other services, the Department of Defense, and the Bureau of the Budget—to Congress. This was later modified materially but never to the extent that bookkeeping could be considered a minor problem. But, in spite of the many drawbacks, the construction mission was a success.

We built many military base facilities in Vietnam. Each of these bases had to have cantonments, storage facilities, roads, electric power plants, communications centers, water supply and sewage systems, and provisions for security. Many also had airfields, ports, and petroleum storage and distribution facilities. Some of the outstanding base facilities and related engineering works included—

- **Ports.** Initially the port of Saigon provided the only unloading facilities in RVN for ocean-going vessels. Its six deep-draft berths were altogether inadequate to handle regular commercial shipping and the hundreds of ships bringing military cargo from America. The result was a monumental shipping tie-up. To alleviate this problem the port capacity of RVN had to be magnified five-fold. Cam Ranh Bay was an excellent natural but wholly undeveloped harbor when the Army Engineers moved there in the spring of 1965. The engineers installed a De Long pier and a causeway pier at Cam Ranh that enabled four ships to be unloaded simultaneously. Six more berths were subsequently constructed in this harbor. Civilian contractors constructed the Newport port facilities on what had been ricepaddy land two miles north of Saigon. As silt from the river bottom was unsuitable for fill, great quantities of rock and sand were brought in by barge and truck. Today, Newport can accommodate simultaneously four ocean-going vessels, four shallow-draft landing craft, and seven barges. Deep-water berths and appurtenant coastal facilities have also been constructed at Da Nang, Qui Nhon, Vung Tau, and Vung Ro.

- **Dredging.** The Republic of Vietnam has been the scene of one of the world's largest dredging operations. Since 1966, 14 or more dredges have been doing harbor and land-fill work in that country. They have cleared and deepened harbors, rivers, and canals; stockpiled sand for road and base construction; and reclaimed land for military, industrial, and housing sites. Without continuous dredging the accumulation of silt would close the harbors and inland waterways to navigation.
- **Airfields.** Eight airfields which accommodate the big jet aircraft were constructed at Da Nang, Chu Lai, Phu Cat, Tuy Hoa, Cam Ranh Bay, Phan Rang, Bien Hoa and Tan Son Nhut. These are huge installations with 10,000-foot runways and the whole range of appurtenant facilities, including administrative buildings, hospitals, hangars, repair shops, warehouses, barracks, officers quarters, and messhalls. In November 1967, of 90 other airfields using expedient surfacing materials, 11 were operational for jets and 62 for C-130 medium-cargo aircraft.
- **Wells.** A massive well-drilling program has accompanied the buildup of American forces in Vietnam. Although the Agency for International Development (AID) has sponsored well-drilling in RVN since 1967, MACV has had to develop its own water supply for the various base facilities. Major work was done under contract to OICC. Between July 1966 and September 1967 contractors drilled 233 successful wells and 48 test holes at 25 sites. These wells have an average depth of 170 feet and an average test yield of 96 gallons per minute. Additional wells have been drilled by Engineer Well Drilling Detachments. As of December 1, 1967, a total of 100 drilled wells has been developed and 14 more were under development. Besides those wells now in production, the records of the well-drilling program will be valuable to geologists and engineers charged in peacetime with the responsibility for developing Vietnam's water resources.
- **Major Command Posts.** Major command posts for MACV and USARV were specially designed to get the American troops out of the scattered offices and billets of the congested city of Saigon. "Pentagon East," as the MACV command post is sometimes called, is situated near Tan Son Nhut Airport. It is a network of two-story prefabricated buildings that provide air-conditioned working space for 4,000 persons. In addition to cantonments and utilities, it includes mortar shelters, security fences, and guard towers. The headquarters complex for USARV was constructed

Ships have no problem unloading cargo here at Cam Rahn Bay. Engineers built the four deep draft piers.

An Engineer Port Construction Company built this POL jetty at Qui Nhon.

Commercial construction equipment is used to gather rock and soil for road building.

Vietnamese receive on-the-job training in construction of building panels and roof trusses in Saigon carpenter shop built by engineers.

at Long Binh, 16 miles from Saigon. It occupies 25 square miles and houses 50,000 soldiers at a cost of $100-million.

- **Troop Construction Projects.** Among the major projects under construction by Engineer troops at the beginning of 1968 were 15 cantonments large enough to accommodate from 4,000 to more than 17,000 men.
- **Road Restoration Program.** This is the largest project of its kind ever undertaken by the U. S. military in a foreign country. It was started under AID and transferred to MACV September 1, 1968. Priorities have been jointly established by military and civil authorities. The goal is to construct and upgrade 4,300 kilometers of national and inter-provincial highways. When completed, the system of two-lane all-weather roads will pass through the Delta, Saigon, northward along the coast, and into the Central Highlands. Standard bridge designs and standard highway and bridge markings and numbering procedures have been adopted. This vast highway restoration project will strengthen the unity and economy of RVN. Lacking the air mobility of USARV, ARVN will utilize the roads to deploy swiftly toward Red-menaced communities. The roads will end the isolation of rural areas and open them to trade.

American engineers will bequeath a rich legacy to the people of South Vietnam when U. S. forces disengage from that country. Much of the construction completed by our forces will serve as the foundation for national development in the years just ahead. Seven deep-draft ports exist where there was only one. Similarly, roads, bridges, utilities, and many airfields and other facilities will remain as valuable assets to the country.

Perhaps the engineering program's greatest impact has been upon the people themselves. Tens of thousands of Vietnamese have had an opportunity to learn American building techniques and many of them have become skilled welders, electricians, plumbers, carpenters, and heavy-equipment operators. Their competence will contribute measurably to the goal of economic viability.

Lieutenant General Carroll H. Dunn, new Director of the Defense Nuclear Agency, is the former Deputy Chief of Engineers. A combat veteran with 33 years of service as an Engineer, the general participated in the landing at Omaha Beach with the 30th Infantry Division and was Director of Construction and subsequently served as J-4 for the Military Assistance Command in Vietnam during the period February 1966 until October 1967. He holds a Master of Science degree in Civil Engineering from the University of Iowa.

COMBAT ENGINEERS IN VIETNAM

Major W. B. Williard

THE FIRST YEAR

The author assembled as historical, eyewitness account of his unit's combat engineering operations during the first year in the Republic of Vietnam.

Despite Napoleon's immortal aphorism that "an army travels on its stomach," historians have pointed out that his Grande Armee's commissary more often than not was in shambles.

Not so his engineers. French soldiers might come close to starving because the Emperor had ruthlessly denuded his wagon train of horses to squeeze an extra cavalry squadron into his screening operations; but rarely were Napoleon's operations delayed because his pioneers and sappers lacked the know-how or the material to throw up a quick bridge at a vital river crossing.

The secret of Napoleon's success did not lie in some sort of "instant commissary," capable of producing a hot meal at the right time and place, but rather in his concept of small, mobile forces. He reorganized the French Army into self-sustaining corps, any one of which was powerful enough to pin a larger enemy force while the others concentrated on the enemy's flank or rear.

The key to this mobility was a corps of capable, well-equipped engineers. Napoleon realized all too well that while his troops could go without food for several days at a clip, they could not go very far without the engineers.

Military history is full of examples which show that ultimate victory in any campaign to a large extent depends on successful engineer support. The current U. S. commitment in South Vietnam is no exception.

Very little attention has been paid to the engineering aspects of the Vietnam War. Correspondents covering the war naturally concentrate on the more glamorous details of combat. Ignored in the box-score statistics that spelled out the success in a given combat operation are the engineering preliminaries that made it all possible.

Following the decision to commit U. S. troops to action in the summer of 1965, the area of combat shifted from the Mekong Delta area and the south to the Central Highlands of South Vietnam. Fully 75 percent of the U. S. ground operations took place in this region—the II Corps Tactical Zone—during the first year of the war in that country.

The 937th Engineer Group (Combat) was tapped for the II Corps assignment by the 18th Engineer Brigade, Command Headquarters for all non-division engineer units. The 937th consisted of three combat battalions (the 19th, 70th and 299th); one construction battalion (the 84th), and several attached companies, including the 509th (Panel Bridge), the 511th (Panel Bridge), the 362nd (Light Equipment), the 630th (Light Equipment), and one platoon of the 497th (Port Construction).

On paper, this assignment looked good. The 937th was the only combat engineer group in Vietnam and it was being assigned to the action area. Its mission was to support the infantry with the building of fortifications, the laying and removal of minefields, and the construction of roads, bridges and heliports.

But things did not turn out this way. Though the 937th received its full share of combat support missions (mainly with elements of the First Cavalry, the 25th Infantry, and the Republic of Korea Capitol Divisions), the group found itself in an engineering situation normally reserved for construction units. Combat engineer battalions were not organized or equipped to perform such large scale and sophisticated projects as those that were assigned to the 937th.

The primary mission of the 937th was to provide base development for incoming combat units and off-loading and storage facilities for the tremendous logistics buildup that followed. The 70th Engineers were moved to An Khe to prepare a cantonment site for the incoming First Cavalry. The 19th Engineers developed 20 miles of cantonment roads in preparation for the arrival of the Republic of Korea "Tiger" Division, and a 25-unit permanent heliport.

The construction battalion (the 84th), which had been in Qui Nhon since June of 1965, continued its port development mission. By October, a floating dock and causeway was completed, allowing lighters to unload some 800 short tons of cargo a day from coastal freighters and tankers anchored offshore. By March of the following year, the Qui Nhon Logistics Depot and additional port facilities were sufficiently completed to allow increased off-loading. Cargo handled rapidly rode past 2,000 short tons per day.

In the first few months of fighting, the First Cavalry Division suffered more than 100 casualties a week and the facilities of the division's field hospital were soon exhausted.

Normally, building a base hospital is the lot of the construction engineers. But there were none so the task went to the 70th combat battalion. They constructed a 200-bed facility (the 2nd Mobile Army Surgical Hospital) at An Khe, the division's headquarters. And at Qui Nhon, elements of the 84th construction engineers went on 24-hour shifts to build the 540-bed 85th Evacuation Hospital.

In October, both the 299th combat battalion and the monsoon rains arrived. The 299th was tasked with hacking and clearing a one-mile square area for an ammunition storage depot in the jungle south of Qui Nhon. Under the conditions, it was remarkable that 10 ammunition storage pads were operational by February of 1966. When a brigade of the 25th Infantry Division arrived in January 1966 even this high-priority mission was interrupted to a degree. One company of the 299th was diverted westward to Pleiku to help the brigade's engineers in base development work, and the construction of an 80-bed hospital, the Pleiku Logistics Depot and Camp Holloway.

In the meantime, the 70th at An Khe was involved in the construction of an estimated 17 miles of perimeter security lighting, the An Khe Logistics Depot, 60 perimeter guard towers with searchlights, Division Headquarters and Administration Buildings, an underground Division Tactical Operations Center (20 feet by 75 feet with no intermediate supports), the Division Heliport and a temporary C-130 Airfield. Later two companies from the 84th constructed a 30-ton ice plant, a dial central office, and the permanent asphalt airfield at An Khe.

The "First Cav" with its helicopter assault concept was the ideal answer to the severe geographical handicaps Vietnam offered. Its personnel could reach any point in the II Corps area from the An Khe base in less than 30 minutes by chopper. But, as time passed, the "First Cav" became less and less mobile. The Vietnamese dust, which is a lot closer in size to sand than powder, literally sand-blasted a chopper's rotor blades. The blades gave out months in advance of their expected wear out expectancy and dust-clogged engines had to be overhauled about twice as frequently as anticipated. So, the helicopter's life expectancy in Vietnam was cut in half.

The dust problem was not entirely unexpected because the division ran into the same situation during training at Fort Benning, Georgia. Even so, the division's planners felt that the choppers could operate temporarily from forward bases in conjunction with a tactical operation. This supposedly would preserve the natural sod and eliminate the dust problem.

This theory was initially tried when the "First Cav" machines were bedded down permanently in the rolling, green hills around An Khe. More than 100 acres were cleared by hand to preserve the natural sod. This land was promptly dubbed the "Golf Course."

In about three months, the "Golf Course" became the "Sand Trap." To make matters worse, it was soon found that the "dust free" period was reduced to just a few days when choppers were used extensively at forward bases.

The dust problem soon became the number one headache for the 937th. It played havoc, creating safety hazards for all vehicle operations and sanitary hazards for all personnel. Also different types of soils in different areas required different dust-proofing measures to further complicate the problem.

A team of soil experts was sent to Vietnam in the spring of 1966 by the Chief of Engineers to find some answers. After an exhaustive study, they reached the conclusion that the only permanent solution to the dust problem was to bury all roads, bases and helicopter pads under asphalt or concrete. However, several stopgap measures were proposed. All of them met with some degree of success on a short range basis. Among them—

- **T-17 Membrane.** Two-ply, neoprene plastic sections 66 feet by 100 feet were glued together to form the membrane, which proved particularly successful in the fine orange clay conditions prevalent in the low, rolling hills around Pleiku. The stress of C-130 aircraft, however, proved too much for the membrane and required continuous maintenance.
- **Peneprime.** An MC-30 asphalt cutback with several chemical additives, peneprime partially met the requirements of heliports and airfields in the laterite-type soils around An Khe. It was less successful in standing up to the stress on road surfaces.

The lack of aggregate used for soil stabilization, concrete and asphalt work presented still another major problem. With only one construction battalion, the 937th simply did not have enough organic crushers to produce aggregate in sufficient quantity to meet the demand. Although additional machines were eventually sent to Vietnam from the States and a small amount of crushed rock could be purchased locally (at less cost than that produced by the 937th's crushers), this problem was never completely solved. In Pleiku, for example, most of the rock outcrops were too hard for the crushers to handle. The efficient operation of quarry sites also proved to be too costly and too time-consuming a process.

Lack of equipment also hampered the group's earthmoving activities when they shifted into high gear in the early months of 1966. The 937th's machinery also was considered too light to get the job done. So the 937th recommended a modification of the Table of Organization and Equipment to give combat engineer battalions an improved earthmoving capability.

As spring arrived and the monsoon season ebbed, U. S. military operations moved into the offensive phase, and most of the 937th's combat engineers returned to their more familiar combat support roles. Heavy emphasis was placed on the construction, rehabilitation and expansion of air bases and small heliports, and bridge construction.

By May, the 19th battalion had completed most of its task of building a mammoth 112,000-barrel tank farm (begun the previous September) near Qui Nhon. Two 4-inch submarine pipelines were installed by the 497th Port Construction Platoon, and by early June, the first T-2 tanker anchored off Qui Nhon was offloading directly into the storage tanks.

The 937th estimated that by late spring it was supporting about 60,000 American and Korean troops. It was impossible for the group to fully support this number of troops so a "Self Help Program" was established. Under this realistic program, personnel of all branches of the Army and Air Force provided the final assembly touches to structures which had been designed and prefabricated by the 937th battalions. Administration buildings, mess halls, billets, bunkers, latrines, water towers, and open storage sheds began springing up rapidly all the way from Qui Nhon to Pleiku.

Late spring also highlighted other 937th accomplishments. The 299th completed most of its work on the Qui Nhon ammunition storage depot and the entire battalion was reassigned to Pleiku to support a brigade of the 4th Infantry Division that had just arrived from the U. S. And the 19th received the additional missions of constructing a 6,000-man COSTAR maintenance area seven miles west of Qui Nhon just off Route 19 and a post exchange facility at Qui Nhon itself.

When the 937th's first year in Vietnam ended in August, it was estimated that the group's operations had cost more than $40-million in construction materials alone. But the most amazing fact to come out of that first year of operation by the group is that the magnitude, type and high quality of the construction was not accomplished primarily by construction battalions with their sophisticated equipment, but by the initiative and ingenuity of the soldiers of the combat engineer battalions. ⊖

Major William R. Williard, Jr. presently teaches environmental engineering at the U. S. Army Engineer School, Fort Belvoir, Virginia. Originally an Infantry officer, he served in Vietnam as a Commanding Officer of C Company, 19th Engineer Battalion (Combat) and later as Assistant S-3 of the 937th Engineer Group (Combat).

Special Training in the Skills

The U. S. Army Engineer Center has launched a training program that is expected to augment mounting shortages in many of the critical construction skills.

Plumbing student learns operation of electric snake from foreman on job site.

Ever need a plumber—or an electrician in an emergency, and couldn't get hold of one? Familiar situation? Homeowners galore have been be-deviled by these circumstances many times.

The Army finds itself in much the same predicament at present, insofar as the availability of soldier-craftsmen trained in construction skills is concerned.

So—what to do?

Harassed homeowner—if he has any practical skills at all, attempts an alternate solution until he can obtain the services of a professional. And if he has any foresight, he seeks to expand his "know-how" to be better able to cope with future emergencies of like nature.

The Army? Not so.

Authorities at the U. S. Army Engineer Center and Fort Belvoir, Virginia, are enthusiastically optimistic that they have devised a program which will eliminate the problem.

Producing and retaining personnel qualified in the construction skills in numbers enough to meet its needs is a continuing difficulty for the Army. Throughout the entire senior service, engineer personnel are expected to provide the expertise that is always required to accomplish the varied carpentry, electrical, plumbing and masonry tasks.

Engineer unit commanders and Facilities Engineers are constantly faced with qualified personnel shortages in these all-important and widely needed skills.

Yet the prevailing climate of austerity under which the military services are currently operating precludes the initiation of any massive training program in these fields. Any such program would be impractical in any case, from the viewpoint of cost per student, and eventually would produce more MOS qualified individuals in these skills than could be absorbed into the military work force.

The Engineer Center has initiated what it calls the Engineer Skills Training Program, which is designed for maximum effectiveness and minimum impact on available resources.

The pilot program is now being tested to determine the feasibility of meeting Army requirements for en-

Electrical students perform practical exercises in connection and installation of switches and control boxes.

gineer soldier-craftsmen, qualified in various construction skills by combining supervised self-study and on-the-job practical, technical training. The scope of the training parallels that prescribed by the Department of the Army for the appropriate MOS, and hopefully will produce skill levels equivalent to those prescribed by the construction industry.

In August, 16 enlisted men—12 from the 11th Engineer Battalion (Combat), and four from the 77th Engineer Company (Port Construction), became the first group to complete this unique training, and to be designated MOS-qualified in the construction fields of carpentry, plumbing, masonry and electricity, without having been required to attend classes at a service school or neglect their regularly assigned duties.

Text material for each of the skills was developed by the U. S. Army Engineer School's Department of Non-resident Instruction at Fort Belvoir. The training packets include the applicable correspondence course, the program of instruction, class schedule and instructor guides. The Director of Facilities Engineering, U. S. Army Engineer Center and Fort Belvoir, is responsible for the technical aspects of the program and assigns the students to the appropriate foreman for "classroom" (i. e. shop) instruction and practical training.

The actual learning process, though quite simple, has proven to be highly effective, according to the several instructors participating in the pilot program.

The student completes the lessons, studying at his own rate of learning, and submits his solutions to various problem solving situations encountered in the text material. Corrected lessons are returned to him by his Training NCO or Officer, who discusses all aspects of the problems with him to insure that the student is completely informed and understands the solutions. The would-be craftsman then applies the knowledge he gained to practical use under the direction and supervision of his instructor—a foreman qualified in the particular skill the student is studying.

Electrical students receive instruction from expert electrician at DFAE.

At the termination of his training, currently planned as a 16-week course of instruction, the student must pass a written examination and a final, graded practical exercise to determine his proficiency and the effectiveness of the training. The applicable MOS is awarded only after successful completion of the MOS test and a demonstration of competence in all tasks enumerated for that particular skill.

For enrollment in the program, an individual must be highly motivated, while voluntary participation is considered imperative in view of the reliance placed on trainee initiative throughout the program. Those undergoing the training cycle must have a GM score of 90 or higher, and a retainability of four months in the service upon completion of the course.

For the individual, benefits are considered to be many, for he learns a trade which is in high demand in the civilian domain. Under provisions currently being negotiated with the construction labor union, the Army Engineer Skill Rating which the student receives upon completing the training program indicates his level of competence, and is intended as an equivalency union rating should he choose to return to civilian life.

Army authorities are highly enthusiastic about the program. Its implementation incurs no added expenses, as text materials are readily available, and additional instructors are not required due to the size of the classes. Unit commanders are now provided a means of obtaining technically proficient personnel, MOS-qualified, without decreasing unit effectiveness or suffering personnel losses to resident schooling.

Although final analysis and evaluation of the program have not yet been completed, it would appear that the system offers a practical and economical solution to a long-standing problem from which other Army units might well benefit.

Engineer troops construct a bridge in the shadow of Nui Ba Din—the Black Virgin Mountain in Vietnam.

MISSION ACCOMPLISHED

Captain Andrew M. Perkins, Jr.

For years Presidents have made numerous speeches and I have never noticed any effect on my life style. But once you don the uniform of your country, this seems to change. You never realize how much effect the President's words and actions have on you until you become part of the gigantic military establishment. Of course, many military personnel never feel his influence until they are assigned to a war zone.

I did not realize the impact of the President's power until shortly after I arrived in my first war zone—Vietnam. Every move we made was influenced in some way by our Commander-in-Chief's words. His influence on me was exemplified shortly after his historic speech in May of 1970 in which he told the American public he had ordered U. S. troops into Cambodia to clean out major enemy sanctuaries in that country.

Within hours after President Nixon's statement that he was committing U. S. forces to support a combat operation which became known as the "Cambodian Sweep," American and South Vietnamese troops were on the move. My outfit, Company B of the 588th Engineer Battalion went along, and not just for the ride. Engineers of the 20th Brigade were among the lead elements of the operation. ARVN troops hit an area appropriately named Parrot's Beak and the U. S. combat divisions moved into a geographic land conformation they dubbed the Fishhook.

For the road-building and land-clearing engineers, the dramatic eight-week operation became 56 brutal days of clock-racing construction and combat.

To the north, east, and south of the Fishhook, what had been a series of insignificant dots in the jungle, became strategically crucial staging areas as the 79th Group Engineers launched an around-the-clock fight to upgrade and maintain them. The names "Katum" and "Thien Ngon" were hitting newspapers around the globe while the 588th Engineer Battalion repaired deteriorating runways and built logistics facilities at both airstrips, in the midst of pounding C-130 landings and one-a-minute helicopter take-offs.

Badly-needed main supply routes, QL-22 and TL-4, were being constructed from Tay Ninh when the 11th Armored Cavalry Regiment and the 25th Infantry Division tanks began rumbling toward the border. To accommodate them, QL-22 and TL-4 were opened to the border by the engineers of the 588th Battalion.

The first engineers to operate from a base inside Cambodia were 53 men from Company B, 588th Engineer Battalion. A vital extension of QL-22 had to be upgraded to TL-7, some 20 miles inside Cambodia, in order to provide a badly-needed supply and withdrawal route. For five days the engineers worked around-the-clock to transform a "trail" into a 20-foot-wide all-weather road to aid the movement of combat vehicles. The road sustained transport movement during the entire operation.

Some 30 miles to the east, Alpha Company, 588th Engineer Battalion, crashed through the jungle border south of Memot on borrowed Rome plows. Behind the plows, earthmoving equipment was cutting out a road that would lay the western portion of the Fishhook open to U. S. armor and facilitate the overland evacuation of fantastic quantities of captured war materials.

As the unit moved through incredibly stubborn and tangled vegetation, enemy sniper attacks hindered the search for natural deposits of laterite, which was needed to give the road an all-weather surface. In our search for this much needed substance, the unit found two bunker complexes loaded with rice, livestock, weapons and an estimated 10,000 pounds of medical supplies. And we accomplished our mission by finding laterite.

Toward the end of the 22 kilometers of driving construction work, the unit was reinforced by members of the 595th Engineer Company. Together, the two units pushed through to Cambodia Highway 7 and to Memot—completing the tactical link far ahead of schedule.

President Nixon had directed that the operation end by June 30, 1970. But as the calendar turned to the month of June and the deadline approached for all Allied forces to withdraw from Cambodia, we were confronted with still another major problem. Heavy winds and rain began building up to monsoon proportions. A real monsoon would have wiped out hastily constructed roads and temporary bridges before the tactical units could get back across the border. My outfit, Company B of the 588th, began a wind and rain-racing, laterite-repaving project to save TL4 south of Katum for an evacuation route during the withdrawal.

When the job was done, we stood by and watched mud-splattered convoys and long lines of tanks stream out of Cambodia over TL-4 to secure areas in South Vietnam on June 29—one day before the withdrawal deadline.

Once again the engineers had played an invaluable support role. Without that 100 percent effort from the engineers, the entire combat operation could have been in big trouble.

Engineers not only helped guarantee the success of the troop withdrawal but their actions also bought some valuable time for the ARVN troops to strengthen themselves for many more battles to come against a deadly and determined enemy.

Captain Andrew M. Perkins Jr. is a graduate of Hampton Institute with a degree in Architecture. A recent graduate of the Engineer Officer Advanced Course at Fort Belvoir, he is now assigned to the U. S. Army Instructor Group, Senior ROTC, Milwaukee, Wisconsin.

THE UGLY TRUTH!

W. T. Spriegel

"The priority of the program is so great that all necessary resources should be devoted to it."

Thus concludes a message last June from the Department of the Army to the Commanding General, Continental Army Command, establishing guidelines for commanders within the continental limits of the United States for treatment of "active duty Army drug dependent personnel returning from Vietnam by aeromedical evacuation."

"It also accentuates the concern of the Army leadership for the problems imposed by drug abuse, and the urgency which is attached to the implementation of measures designed to counter the misuse of drugs by Army personnel," says Brigadier General Robert G. Gard, Jr., Chief of the Army's Directorate of Discipline and Drug Policies, Office of the Deputy Chief of Staff for Personnel, Department of the Army.

In consonance with a concerted Department of Defense and national effort to combat this menace to the health of military and civilian personnel the world over, and the adverse impact which it imposes on operational efficiency, the Army has gone all out to develop an accelerated, comprehensive program to control drug abuse.

General Gard is charged with that mission, and has just recently returned from an extended trip to Vietnam to see first-hand what progress was being made in implementing local programs.

"We have had a remarkably successful response in the initiation of short term programs," the general reported, "but we have discovered that education of our own personnel is paramount, if we are to be successful in our efforts to control drug abuse, or minimize its use."

Considering the numbers of engineering personnel in Vietnam—and the likelihood that they may well remain in that country for some time in support of the Vietnamization program—the Army's rapidly expanding program to fight drug misuse is of particular significance to engineers worldwide.

Within the Continental Army Command, the First U. S. Army at Fort G. Meade, Maryland, became the first command to publish a definitive Alcohol and Drug Abuse Program, based on the guidelines provided by General Gard's office. Details of the First Army Program were announced and disseminated to subordinate units within that command in mid-July.

Using such guidelines, installations within the First Army Area reacted with speed and effect to initiate their own local programs similar in pattern, such as that now in operation at the "Home of the Engineers" at Fort Belvoir, Virginia.

The programs have four main objectives:

- Prevention—which encompasses educating the individual as to the dangers of drug abuse, and aggressive law enforcement in efforts to reduce the availability of illegal drugs.
- Identification—through which drug users are encouraged to volunteer for treatment.
- Rehabilitation—the first step toward which is detoxification . . .
- Data collection and analysis—through which critical evaluation of the program may be made.

"The increasing use of heroin among soldiers throughout the world is our greatest concern," says General Gard, "particularly among those in Vietnam where high potency drugs are readily and easily obtainable at little expense. Heroin is our primary and most immediate target, and the Army has zeroed-in on that aspect of the burgeoning drug problem which we are bending every possible effort to solve. Highest priority is being given to the identification and detoxification of heroin users before they depart Vietnam—and arranging for follow-on treatment as required upon their arrival in the United States," he declared.

In its counter-offensive against drug misuse, the Army has expanded the identification process to include amphetamines and barbiturates, in addition to opiates, with testing and treatment on a worldwide scale being pushed vigorously. It is anticipated that by November, world-wide spot checks, treatment and rehabilitation of drug users will be underway, although in overseas areas such care at first will, of necessity, be austere.

Three techniques are now in use in the Army program for the detection of drug users:

- The Free Radical Assay Technique (FRAT)
- Thin Layer Chromatography (TLC)
- Gas Liquid Chromatography (GLC)

Despite rumors to the contrary, urinalysis by these methods for the detection of drug users has proven to be highly reliable. In fact, it has been reported that there is no substance known to Army toxicologists that will mask the presence of the drug being tested under this system.

To augment tests performed by military medical technicians, the Army has contracted with civilian laboratories to conduct urinalyses. Such firms report their findings by telephone within 24 hours, and confirm the tests in writing within seven days. These tests are more than 98 percent reliable, according to authorities.

Meanwhile, in Vietnam, urine testing machines are operating daily at the Army's replacement centers at Long Binh and Cam Ranh Bay, where all personnel slated for return stateside are tested prior to departure.

Individuals testing drug positive are quarantined for a maximum of seven days in detoxification areas, under medical control, where withdrawal from drug use can be effected.

General Gard cautions, however, that although physical dependence on heroin can be rather quickly eliminated, the hazard of psychological dependence may well remain because it is a most difficult condition to treat.

To combat that situation, the patient receives highly intensive counseling and close medical observation during the detoxification period, by both psychologists and social workers—and, if necessary, by psychiatrists.

Current policy now provides that all drug users be returned to the United States under medical evacuation, after detoxification and outprocessing. Upon arrival back home they are counseled further as a follow-on measure, and are told about all of the specific treatment facilities available to them.

Urinalysis screening in Vietnam has been extended to include personel requesting extensions, and those departing on leave or for rest and recuperation (R&R). If heroin traces are detected, detoxification and follow-up treatment replaces the individual's proposed absence for such purposes. Current policy precludes ordinary leave or R&R for personnel unless it is verified that they are not drug dependent. The policy does not apply to emergency leaves, however.

In Thailand, SEATO facilities are being upgraded to accommodate urine testing of both Army and Air Force personnel. By November 1, that capability hopefully will be available. Meanwhile, specimens from that area are flown to Vietnam for analysis, with detoxification and med-evacuation to the United States in accordance with the foregoing procedures. Screening for drug use began in Thailand on July 23.

In other overseas areas, similar measures have been implemented. Laboratory analysis is being accomplished in-country if civilian facilities are available, otherwise analysis will be done in the United States. As of the moment, screening of personnel returning to the U. S. for leave, or new assignments—or requesting extensions of their tour has been phased in.

In most areas, dependent families and civilian employees working overseas may voluntarily participate in the Army drug detection program.

Here in the United States, Army authorities are taking unprecedented steps to stave off the onslaught of drug abuse.

During separation briefings at processing points in Oakland, California, Fort Lewis in Washington, and at Fort Dix, New Jersey, dischargees who have been on heroin or other drugs are urged to seek help, if needed following separation, from one of the drug testing centers operated by the Veterans Administration (VA) or other civilian programs.

Although VA capability to treat drug users is presently limited, it has been announced that 27 new drug treatment centers have recently been opened (October 1) to augment the five VA centers previously in operation. This expansion will permit the care of an additional 6,000 veteran drug-dependents, and will relieve long-term burdens on military facilities by phasing extensive treatment cases into VA rehabilitation programs.

The Army program is one which is non-punitive, and offers amnesty to the soldier who has the guts to face his problem, and wants to kick the habit. Under the immunity—or amnesty—policy, no soldier will be subjected to disciplinary measures under the Uniform Code of Military Justice, or discharged under other than honorable conditions, solely on the basis of volunteering for treatment, or identification as a drug user through urinalysis. This is an integral part of the drug abuse program which encourages those dependent on drugs to voluntarily seek treatment.

The policy, however, does not exempt the soldier from other legal consequences as a result of violation of other laws and regulations, if such disciplinary action is supported by evidence not attributed to urine testing or volunteering for treatment.

According to official statistics, the amnesty feature of the Army's program has had positive effect. For instance, in Vietnam during the first five months of this calendar year—January through May—more than 6,800 persons of all services voluntarily turned themselves in for treatment—an average rate per thousand of 54.6. During the months of June and July, a total of 4,523 persons—or an average of 113.5 per thousand—entered the program.

One of the most important agencies in the rehabilitation of drug dependent personnel is the "Halfway House." Commanders throughout the Army are being urged to establish such an activity as soon as they possibly can do so to help drug users make the switch from hospital to full duty.

Although rehabilitation of drug users actually begins with detoxification—as pointed out earlier—soldiers remaining on active duty, if they really want to "make it," go into an outpatient program of community-based therapy, activity and involvement.

Under the concept of the Halfway House, the soldier spends his duty hours at his unit and stays in the Halfway House after duty hours. Staffed with both medical and nonmedical personnel, the Halfway House system provides housing arrangements and structured activities during non-duty hours—and includes occupational therapy, individual and group counseling, group recreation, and other activities under the close supervision of professional counselors.

During the rehabilitation process, periodic checks through urinalysis—probably about twice weekly—will be conducted. "Rehab-success" will not be confirmed until a patient has undergone a series of "clean" urine tests, and has demonstrated that he is psychologically fit for return to full duty.

If the drug user is unable to pass such tests after a minimum of 60 days rehabilitation effort, he will be considered a "rehab-failure" and administratively separated from the service.

Before separation, he will be referred to the VA or other civilian treatment facilities for follow-on care. Dischargees are referred to specific treatment facilities and given help in making necessary appointments.

Other rehabilitation centers are being pushed by the Army, under its concerted attack against the misuse of drugs. These centers, which will be used for both the prevention of drug abuse and the rehabilitation of those using drugs, will provide various services—individual counseling (psychotherapy), group counseling (group psychotherapy), drug information, rap sessions, recreational activities and referral.

Such centers will operate around the clock, with a hot line telephone for advice and assistance to those calling in with a drug problem—much like the highly successful operation which Alcoholics Anonymous conducts.

Authorities warn that drug abuse is often a chronic condition with occasional relapses, and that short term rehabilitation should be considered on the basis of progress and estimated potential for improvement, rather than as a success or failure. Decisions concerning adequate progress should be delayed until the patient has been afforded a reasonable period to demonstrate his attitude toward rehabilitation—normally after he has been on-post for about 60 days, and then only after consultation with appropriate medical and other specialists.

The Army's concern with what has become an American epidemic is shown in the massive and urgent campaign which it has mounted. Statistics and data about the extent of drug abuse in society are difficult to pin down because drug users, like alcoholics, are good at concealing their problem. Yet both categories subscribe to the same philosophy—the world is wrong—not them. Their problem is one not of their own doing.

Such an attitude is difficult to overcome. Such an attitude, people are beginning to realize, is more closely related to illness than to more unconventional behavior.

Science recognizes that, in the case of drug addicts, some are so psychologically strung-out that they will never kick the habit, or even want to do it.

Many persons who have been successful in shaking the habit, exhibit an enthusiasm about the "clean feeling" they experience. That enthusiasm, and the assistance of such former drug users in rehabilitation efforts for those "still on the hook," have been most helpful.

"Scare tactics" are unnecessary to combat drug abuse. Facts alone are sufficient to make the nonuser have second thoughts before the first "hit." The Army's program is aimed at prevention, and to stop the non-user from starting on drugs.

At the same time, former addicts emphasize the need for a "natural high—something that will involve them, something in which they can lose themselves—such as music, nature, or helping others. But they need the compassion which those around them can provide—they need an environment of understanding.

As General Gard puts it: "We must endeavor to reorient institutional attitudes toward the problem of drug users to provide a more receptive environment and proper support for them. We must divorce ourselves from an outlook upon the drug user as a common criminal. We must accept the premise that not all addicted to the use of drugs are beyond help and rehabilitation."

As to possible changes in the Army's rapidly expanding program, General Gard says that current accent will be to stimulate innovation in the present program—that there is no absolute conventional wisdom as to the best approach to use; that a variety of modalities will be tried—but that education of our own personnel is paramount to any successful outcome.

FROM CONCEPT TO REALITY

CAPTAIN JOHN J. CONNOR

The recent study conducted at the Engineer School involved actual working situations, where the proposals of OCE and CDC were put to the test by the advanced course students. Their findings will suprise many engineers.

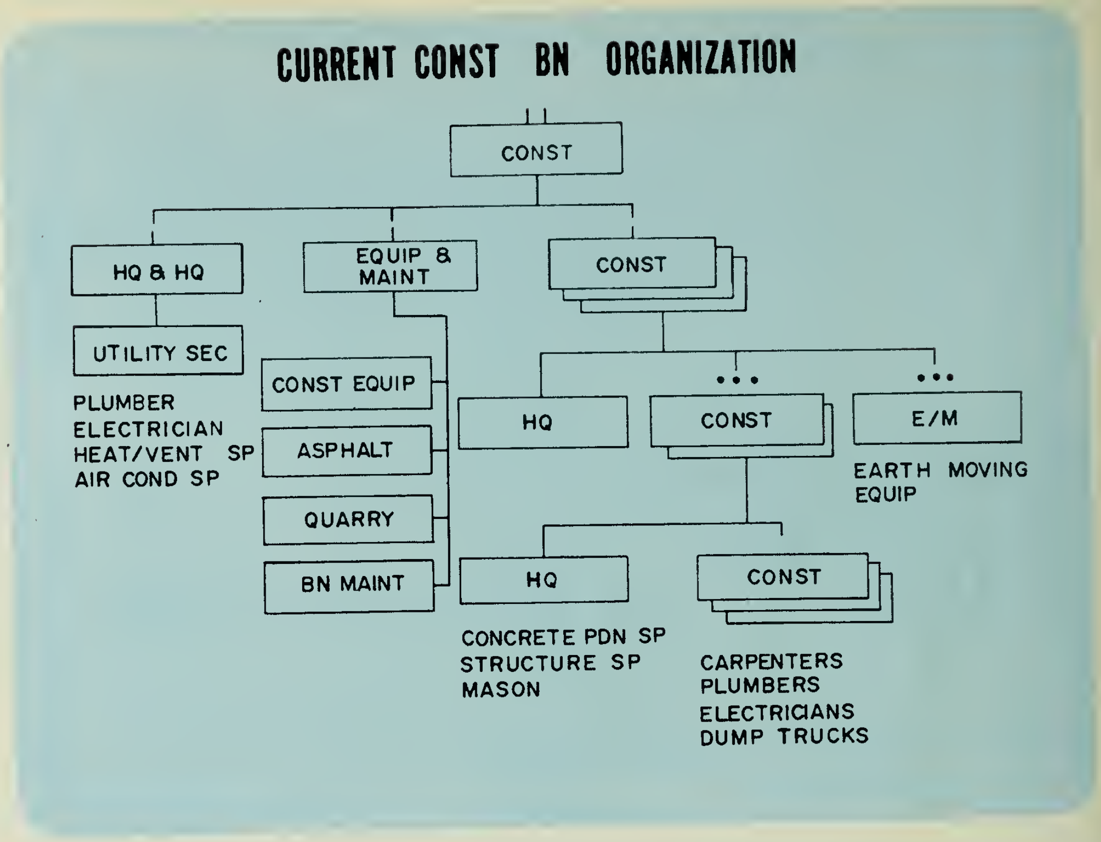
Have you ever heard of the 515th Engineer Battalion (Construction)? Do you know where it has operated recently? If you can't answer either of these two questions, don't feel bad, because the 515th exists only on paper at the U. S. Army Engineer School at Fort Belvoir, Virginia. It is the designation given to four student groups that took part in an evaluation of proposed revisions of the organization of the Engineer Construction Battalion. The exercise, referred to simply as CONBN, was conducted by the school's Construction Engineering Division. This classroom evaluation is just the latest in a series of developments that began in September 1969 when Lieutenant General Frederick J. Clarke, Chief of Engineers, directed that a study be made to re-examine Army engineer organization structures following a policy statement from the Army Chief of Staff on "Austerity and the Future of the Army".

The current structure of the Construction Battalion consists of a Headquarters and a Headquarters Company, one Equipment and Maintenance Company, and three Construction Companies. In addition to normal headquarters personnel, the Headquarters Company contains plumbers, electricians, and heating, ventilation and refrigeration specialists. The Equipment and Maintenance Company is comprised of a construction equipment section, asphalt section, quarry section, and a maintenance platoon. The three construction companies are identical and comprise one earthmoving platoon and two general construction platoons. The construction platoon headquarters includes structure specialists and masons, while the squads (18 in the entire Battalion) are comprised of carpenters, plumbers, electricians, and dump truck drivers.

One of the recommendations made by the board of officers that conducted the study within the office of the Chief of Engineers (OCE) was a reorganization of the Construction Battalion along "functional" lines as opposed to the current "balanced" construction capability now in effect. The board proposed consolidation of personnel by skills to permit "subcontracting" of manpower and equipment to construction tasks as required in the same manner as a civilian contractor. It also recommended that a battalion within the Continental United States be reorganized to test this concept under a normal range of engineer mission assignments, concurrent with development of a new Table of Organization and Equipment. The proposal was favorably received when presented to the Army General Staff Council and as a result, the Assistant Chief of Staff for Force Development tasked the Combat Development Command to perform a "detailed examination and evaluation of the proposed new construction battalion concept in light of current and probable future doctrine and reqirements."

The OCE concept consolidates functions at company level and reduces administrative overhead without a decrease in construction capabilities. This new battalion would be composed of a Headquarters and a Headquarters Company, two general construction companies, one earth moving company, and a materials support company. The Headquarters Company would contain a consolidated mess and a communications section, each

This block diagram displays the current "BALANCED" concept, with each construction company having similar engineering capabilities.

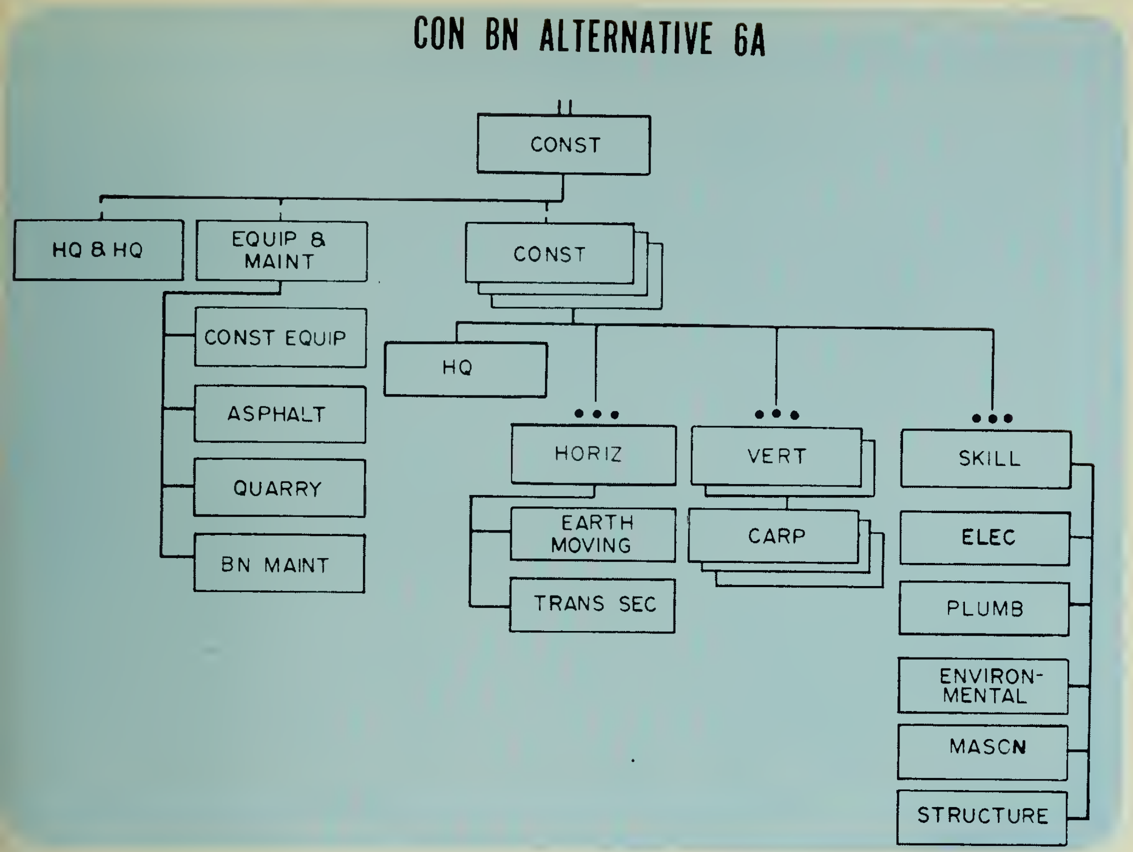


capable of supporting project sites, and a battalion direct support unit for engineer equipment. The Materials Support Company would provide specialized equipment and construction materials support, and would consist of a concrete section, asphalt section, quarry section, and materials section. Equipment would include 18 dump trucks (12 cy capacity), a 150 TPH rock crusher, and three mobile concrete mixers (24 cy/hr). The Earthmoving Company contains the three earth moving platoons of the current battalion and a maintenance section. Equipment includes dozers, scrapers, and compaction equipment, but no dump trucks. The General Construction Companies are organized to do vertical type construction and consist of a general construction section composed of carpenters, structural specialists, and construction helpers; a utility section composed of electricians, plumbers, masons, refrigeration, heating and ventilation specialists, and a utilities helper; and a support section composed of equipment and equipment operators needed to support other sections.

Construction operations of this battalion are envisioned to be similar to those of civilian contractors. The staff organization represents a distinct departure from the traditional S-1,2,3,4 staff. It is a double deputy system (Chief, Support Operations, and Chief, Construction Operations) in which planning and management of construction operations is highlighted. There is no executive officer, so in the absence of the battalion commander, command is passed to the senior chief.

It was with this background information that the Combat Developments Command Engineer Agency began its study in March 1970 "to identify improved alternative organizational structures for the Engineer Construction Battalion, where, through improved management techniques and the introduction of modernized construction capabilities, manpower savings can be realized without degrading the battalion's capabilities". The study employed both quantitative and qualitative techniques to determine the construction requirements placed on an engineer construction battalion and the resulting required capabilities.

After the identification of essential construction equipment and skilled trades, unit building blocks were developed to permit incremental changes to the existing Table of Organization and Equipment (TOE). Finally an analysis was performed to determine the savings which would result from the pooling of skilled manpower and the introduction of off-the-shelf commercial construction equipment (CCE). The study resulted in seven alternative organizations, of which the first four are the same basic organization as the current battalion. Alternative number five and seven represents OCE's functionalized company concept, while number six pro-



This concept takes the present "BALANCED" capability and functionalizes skills at the company level.

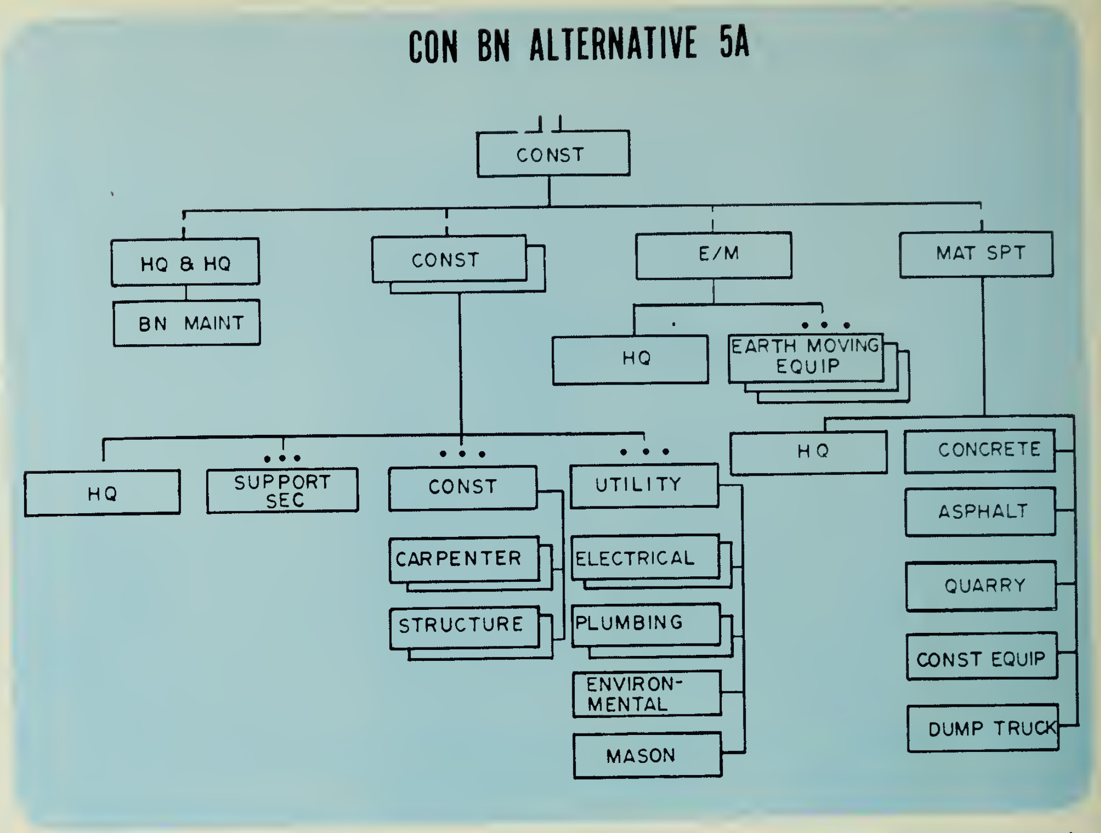
vides for functionalized platoons and sections in an organization essentially the same as the present battalion. Each alternative provides single and double shift op-ions.

The study recommended that a new tentative TOE e prepared for the engineer construction battalion ased on the modified functionalized concept of alterna-ive number six, and that a battalion be reorganized and quipped with commercial construction equipment for a ield evaluation to be conducted in Europe. It also con-luded that the recommended changes could be accom-lished at a savings in the number of personnel required and at essentially the same 10-year dollar cost.

The modified functional battalion recommended by he CDC study is composed of a Headquarters and eadquarters Company, an Equipment and Maintenance Company and three Construction Companies. The HQ and HQ Company has the normal complement of headquarters element and contains no maintenance r construction capabilities. The organization of the quipment and Maintenance Company is essentially he same as in the current battalion, but in the three onstruction Companies major changes are found as hey now consist of four platoons each, namely a orizontal Construction Platoon, two Vertical Con-truction Platoons, and a Special Skills Platoon. The orizontal platoon contains the entire earthmoving capability of the company and is comprised of an earth moving section and a transportation section which consolidates all of the company's dump trucks. The two vertical platoons consist solely of carpenters and their tool sets, while the special skills platoon is organized into functionalized craft sections and includes plumbers, electricians, masons, structure specialists, and heating and ventilation specialists. With this type of organization each craftsman can now obtain the grade of Specialist Five in his own work section as opposed to the current maximum of Specialist Four, and can progress up to Platoon Sergeant (E-7) in the general field. This will result in higher skill levels and enhance personnel retention.

Neither the OCE or CDC organizations have been field tested as yet and no immediate plans to do so have been announced. Austere conditions in Europe, accelerated redeployment from Vietnam, and longstanding congressional limitations in CONUS make the prospects of a field test of both concepts doubtful and of either concept uncertain. The productivity of a functionally organized battalion has, however, already been proven by field experience. The Engineer Command, Vietnam, reports that the 815th Engineer Battalion (Construction), which has been functionally organized for work on the LOC program, (See "LOC" in the spring issue of "the engineer") "has proven to be one of our

Diverting from the other concepts, CDC's proposal functionalizes skill capabilities at the platoon level. The students favored this concept.



best producers both quantitively and qualitatively". Initially, plans were for the line companies (B,C, and D) to be responsible for the complete construction of a portion of the road—Less paving which would be done by A company—but this organization proved highly inefficient. The battalion was reorganized to make each platoon and company a specialist in one function (earthwork, subbase, haul, etc.), increasing production in all areas at least 100 percent. The 36th Engineer Battalion (Construction) has had similar success with a functional organization.

It was at this point that the Engineer School's Office of Doctrine and Training Development and the former Department of Engineering and Military Science began formulating a method of evaluating the CDC and OCE organizations in a classroom exercise. Working under the guidance of Colonel Charles S. Reed, Jr., (Director, D/E&MS), Colonel Walter R. Hylander Jr. (Director, ODTD), and Lieutenant Colonel Donald A. Ramsey (Chief, Construction Engineering Division) a 30-hour "war game" was prepared by Captains John F. Sheffey and Kevin J. Mahoney, members of the Engineer School faculty, to test the command and control and management afforded by the two organizations.

The students of class 2-71, Engineer Officer Advanced Course, were selected to participate in the evaluation and were divided into four battalion staffs (two for each proposed organization) and a 10-man umpire staff. The Chief Umpire for the exercise was Major Gerald A. Vick, class leader of 2 EOAC. The first 10 three-hour sessions was held on June 28, 1971, at which time the proponents of the two concepts briefed the students after faculty controllers had outlined how the exercise would be conducted. The second and third sessions were devoted to Standard Operating Procedures and TOE study. Sessions four, five and six tested the battalion in a centralized project, while sessions seven, eight and nine presented several decentralized projects. In both cases "conflicts" were introduced to test specific elements of the organization. To simulate physical separation that would normally require communications by radio or telephone, written solutions were required. Only those personnel who would work in close proximity, such as the Battalion Commander, and his executive officer were permitted to converse during the solutions of the conflicts. The students were charged to exert every effort to make their organization work regardless of personal preferences. A final written report was required identifying the preferred TOE and its advantages. This report was presented at a briefing on August 2, 1971. The students decided overwhelmingly in favor of the organization proposed by CDC, with 85 percent selecting this concept. The five main areas which influenced this decision were: command, staff

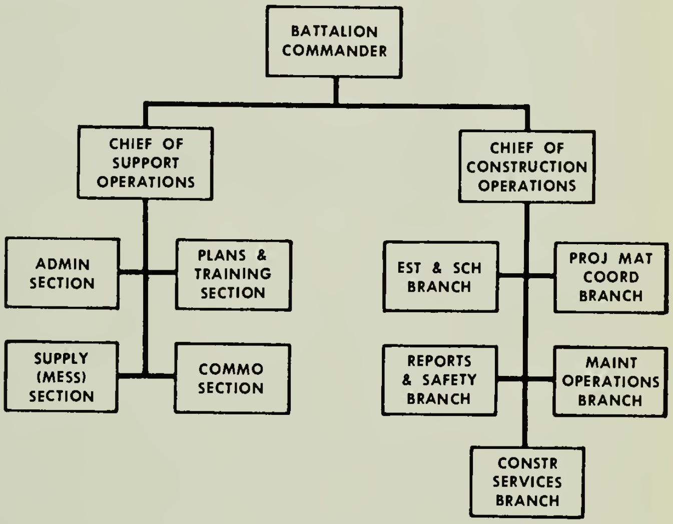
Student Survey Results	PERCENTAGES PREFERRING . . .					
	of 75 who selected CDC		of 13 who selected OCE		totals (88)	
	CDC	OCE	CDC	OCE	CDC	OCE
a. Administration	85	8*	61	31	82	11
b. Staff Organization	84	13	15	85	74	24
c. Task Assignments	82	12	0	100	70	26
d. Area Assignments	82	11	23	77	73	21
e. Planning of Construction Tasks	43	48	8	92	38	55
f. Identification of Responsibilities	100	0	85	8	98	1
g. Chain of Command	99	0	62	31	93	5
h. Logistics Support	49	33	0	92	42	42
i. Ability to Tailor Assets to Projects	55	31	15	85	49	39
j. Self-Defense	71	3	62	15	69	5
k. Unit Integrity	97	1	92	0	97	1
l. Job Efficiency	70	15	8	77	59	24
m. Maintenance	60	19	0	92	51	30
n. Communications	59	7	38	23	56	8
o. Mess Operations	73	16	46	54	69	22
p. Morale of Troops	93	1	38	23	85	5
q. Efficient Use of Earthmoving Equipment	40	45	0	100	34	53
r. Conduct of Training	72	11	15	46	64	16
s. Supervision of Personnel During Hours	86	3	8	62	75	11
t. Supervision of Personnel Off Duty Hours	79	0	42	0	73	0
u. Efficient Use of Officers	90	3	8	85	78	15
v. Efficient Use of NCOs	76	13	0	92	65	25
w. Span of Control	93	0	25	50	84	7

*** figures do not total 100% because of "no difference" answers**

organization, the number of officers at company level, administration, and flexibility.

Both the OCE and CDC concepts faired well in the centralized situation, but in the decentralized situation the OCE organization showed several significant weaknesses. In only two areas did the majority of the students feel that the OCE concept was overall superior, namely, the planning of construction tasks and the efficient use of earthmoving equipment. In general, the OCE concept faired well in construction related categories but was found lacking in the peculiarly military areas such as chain of command, responsibility, unit integrity, morale, use of officers, and off-duty supervision of personnel.

In assessing the student's findings, it must be remembered that the exercise offered a choice between only two alternatives. Neither the present G-series TOE, nor any other possibilities were compared, and certainly the classroom cannot duplicate actual field conditions. The students learned plenty from their work and the opportunity to debate the merits of a new orgazation. Even so, they still must wait to see the final results of their labors. The 515th Engineer Battalion (Construction) still exists only on paper!



In proposal 5A, OCE employs the new concept of a double-deputy staff in lieu of the traditional S-1,2,3,4 arrangement.

Captain John J. Connor is a graduate of Engineer OCS, and has a degree in Geology from Boston College. He is an instructor in the Department of Engineering Sciences, Foundations and Materials Division, Soils and Geology Branch at the Engineer School.

SOLDIERS OF THE DEEP

1LT M. J. TERCY

"Because it was there", is a familiar phrase which beckons to those men seeking the thrill of adventure. Some may set out to climb giant mountain peaks, while others may try "shooting the rapids" of some treacherous river in a small canoe. But to the men who display the badge of the U. S. Army Diver, adventure is routine and risk is simply part of the job.

Most people might think of the Army Diver as the typical "devil-may-care" soldier, who breeches submarine nets to infiltrate an enemy coastline. Although he may be called upon to perform such a mission, his knowledge and capabilities go far beyond such activities. Because of knowledge of diving and the training he receives, the diver will take no unnecessary risks which may jeopardize his own life, or the mission at hand. He is a professional by all standards.

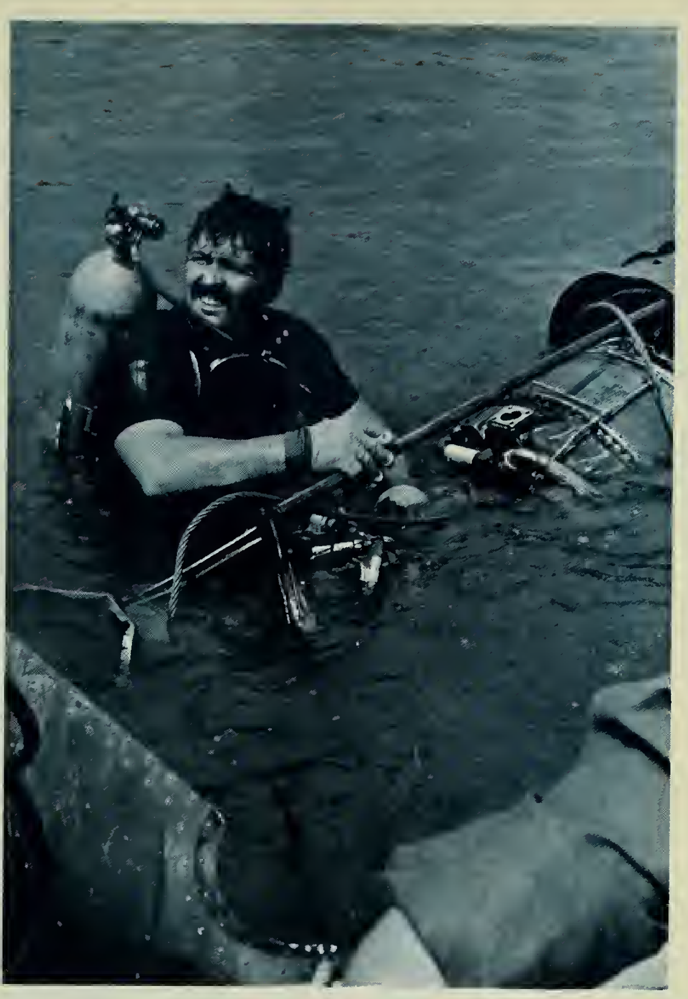
Military divers can trace a proud history back to the time of Ancient Greece. Alexander the Great employed divers while destroying the defenses of Tyre in 333 B.C. In even earlier accounts, Herodotus relates the story of Scyllis, who dove to recover sunken persian treasure for Xerxes. But the U. S.

Army Divers of today came into existence at Fort Screven, Georgia, back in 1943. The first Army Diving School took shape there, but three years later in 1946, moved to its current location at Fort Eustis, Virginia.

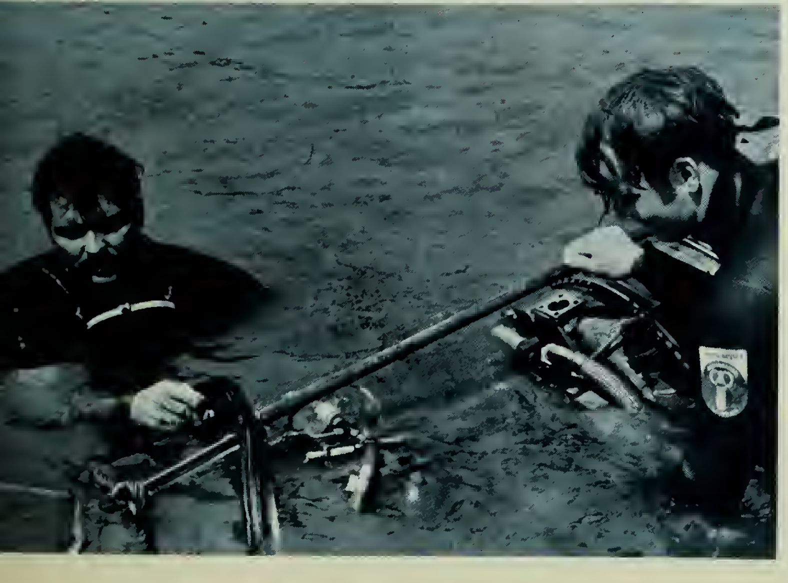
A diver's training begins with a strong emphasis on physical fitness. To be selected for the diving school, a prospective student must pass the standard U. S. Army Physical Combat Proficiency Test (PCPT), and a series of swimming tests both on and below the water. The keynote here is endurance and coordination.

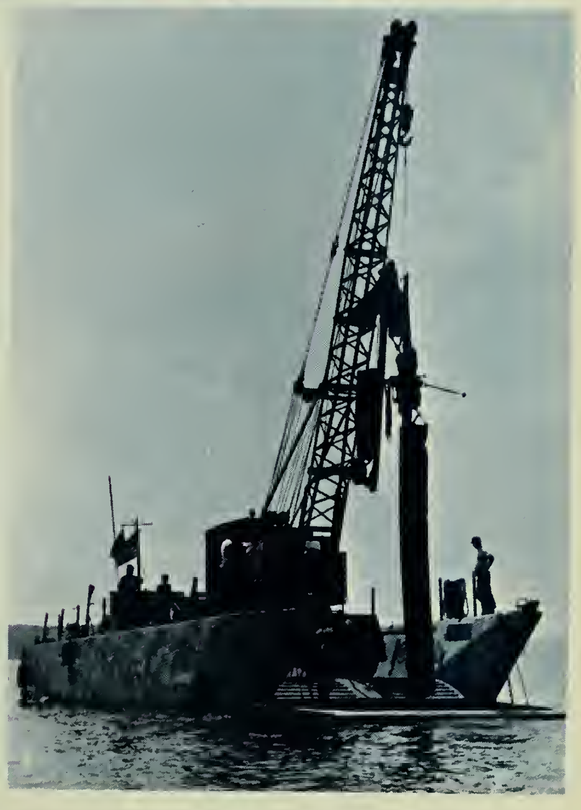
Chief Warrant Officer Donald L. Branham, who heads the diving school at Fort Eustis, states that the attrition rate is as high as 50 percent. Although the men who apply for the school are all volunteers, the demanding requirements narrow down the classes in the early weeks of the program. Of those individuals who drop out of the school, most fail to meet the standards because of lack of swimming ability, or they succumb to the pressure tests administered at the beginning of the course. Motivation is not a key factor contributing to the rate of attrition. The divers are a small select group of individuals, and commitment to their job is a life or death necessity.

The school is staffed by two Warrant Officers and seven Noncommissioned Officers. All have a wealth of diving experience and a proficiency which comes from dedication to their work. With the physical training portion of the course, they combine intensive classroom instruction on all



The two scuba divers (below) inspect the wreckage of a downed helicopter, and after attaching a cable (above), the wreckage is lifted from the water (right).





subjects related to the field of diving. The potential diver is taught everything from the basic principles of underwater safety to a working knowledge of diving physics. In short, the diver must be able to assimilate himself to every aspect of the underwater world he will inhabit.

To provide the student with an inherent flexibility, he is taught the techniques of both self-contained (SCUBA) and surface-supplied of deep sea diving. The diver must fully understand the capabilities and limitations of each system, so he can determine what equipment best suits a given job.

The most familiar system of diving is scuba. With the scuba equipment a diver has portability, maneuverability, and flexibility while working. The only limiting factors with scuba equipment are the duration of his dive and the depth to which he can descend. Of the three advantages of scuba, portability is a major factor of consideration for planning any diving operation. It simplifies the establishment of an operation by allowing for a large number of divers to be easily deployed so many divers can operate at the same time. Independence of operation is another major asset of scuba gear. The diver can work on his own, shifting his attention to many areas if necessary.

Although lacking the numerous advantages of scuba equipment, the surface-supplied or deep sea diving equipment is of equal importance. With the deep sea outfit the diver requires a supply of air generated from the surface. Normally, the deep sea diver also requires at least two men on the surface tending his life lines, and monitoring his underwater activity. This method of operation is usually employed where the divers work is confined to a small area, and stability is of paramount importance. The actual diving dress of the deep sea outfit provides the diver with maximum protection against the undersea elements. With this suit the diver can operate in even the most rugged terrain. Great depths and other special requirements may also necessitate the use of surface supplied equipment.

Experience is said to be the best teacher, and so it is for the divers. At the school, practical exercises are conducted in a 30-foot diving tank. Here the students become familiar with both scuba and deep sea diving procedures. While working in the controlled environment of the diving tank, they can work out any problems under the direct supervision of the staff. It is here also where they learn the basic techniques of underwater work such as welding and the use of various types of tools.

A scuba diver prepares to surface from the depths during a training exercise.

To add a greater amount of realism to the practical exercise, the school has converted an old barge and created a floating classroom. The only one of its kind, the floating classroom is fully equipped to tender and communicate with six divers at the same time. Excursion tours are planned with the "Barge" where the students participate in simulated underwater repair and salvage work, as well as blasting and demolition techniques and port rehabilitation.

The entire course at the school lasts for 23 weeks. The training a diver receives takes him through the first three stages of development. A student starts out as a "Diver Tender" with a basic MOS of 00B10. There is no hazardous duty pay at this skill level since the training is primarily an introduction preparing the students for underwater work.

Upon successful completion of the first phase of training, the student is awarded the "Scuba Diver" rating with an additional skill level added to his MOS. Accompanying the new rating is an additional increase in pay. At the scuba level, a diver receives an extra $65 a month. This additional pay increases as each new skill level is attained. The Master Diver, which is the highest rating a diver can acquire, receives the maximum amount of $110 monthly.

While attaining his rating, the diver assumes

Two divers helpers dress a soldier in deep sea gear (above), while (below) the diver begins his descent from the "floating classroom."

new responsibilities. He gains complete knowledge of his equipment, and learns to keep it operational under the most adverse conditions. Also he must be competent in underwater repair, methods of salvage, and be proficient in techniques of underwater demolition and blasting.

At the end of the course at the diving school, the student becomes a qualified Army Diver. Each student is given the rating of "Salvage Diver" with the MOS of OOB30. It is only when he achieves this final goal that the diver is ready to put his technical knowledge to practical use and provide invaluable support to units in the field.

One such unit with an organic diving capability is the 77th Engineer Company (Port Construction) based at Fort Belvoir, Virginia. This unit is the only one in the continental United States with a diving capability that can be mobilized and deployed to any point on the globe where diving support is required. The 77th has a complete range of undersea equipment, which allows the divers to meet any underwater requirement. Salvage Diver Jack Brust of the 77th stated that given the job, they could float anything anywhere.

Last year, the divers from the 77th teamed up with divers from the 73rd Transportation Company of Fort Eustis, Virginia, to participate in a marine research project called TEKTITE II. The operation, which took place off the Virgin Islands, was conducted in an undersea habitat to study the movements and habits of marine life. The divers performed as safety teams to insure the well-being of the scientists below.

Of their more recent jobs, the divers of the 77th assisted the Savannah District Corps of Engineers at the Clark Hill Dam and Reservoir in Georgia. The job was to free the waterway from existing obstructions. After inspecting the project site, the operation was carried out. Using more than 3000 pounds of C-4 explosive, the divers removed approximately 200 trees below the surface of the water. When the mission was completed, the river was able to flow unobstructed, and provide the increased need for more water.

These two accounts are but a cross section of the services performed by the divers. Each mission provides a new challenge to be met and overcome. But perhaps there will be occasions in drydock when time goes slow and the divers long for the sea. However, once again in diving dress, diving to some new depth of adventure, they will proudly carry out their mission as professionals of the Corps of Engineers. ⊖

Lieutenant Michael J. Tercy is a former Associate Editor of **the engineer** Magazine. He is currently assigned to the Engineer School, Fort Belvoir, Virginia, as Aide de Camp to the Assistant Commandant.

Bridging

FEW FORMER OFFICERS QUALIFIED FOR RECALL UNDER CURRENT PROGRAMS

THE DECISION TO LEAVE active duty in the Corps of Engineers has always been an important one. In view of the very limited opportunity to return, the decision to leave becomes even more significant. During the past fiscal year, the Engineer Branch has received numerous inquiries about returning to active duty from former Engineer officers, both regular and reserve. But only a small number of these officers have been qualified for recall under current programs. Only those junior officers who compiled an outstanding record while on active duty can be invited to return to the Corps. While some former officer's motivation for wanting to return is stimulated by current civilian job opportunities, in most cases this is not the reason.

Many officers and their families have later realized that their decision to leave the military was not what they really wanted. These officers have since found they are motivated toward a military profession and desire to pursue a continued military career. It is unfortunate that many highly competent officers will not fulfill their desire to return to the Corps since competition for the limited spaces available is very rigorous. So, if you are having thoughts of leaving the Corps, it would be worthwhile to reevaluate your motives. Is it what you really want? Think it over.

REGULATION BLOCKS FINAL TOUR PREFERENCES FOR MANY OFFICERS

SOME OFFICERS approaching retirement cannot get their "final tour" preferences. Rules are covered in AR 614-100. To clear up apparent misunderstandings, the key points of the regulation are: • An officer must be returning from an overseas assignment to qualify. Intra-CONUS moves purely for retirement purposes are not permitted. • An officer must be scheduled for mandatory retirement as opposed to his stated intent to retire voluntarily. • A valid requirement must exist for an officer to get the final tour of his choice unless he has between 120 and 180 days of service remaining and is returning from a short tour. The branch makes every effort to assign officers to the station of their choice when it is known that retirement is imminent. However, the rules sometimes restrict the branches efforts to meet an individual's desires.

SOME OFFICERS MAY QUALIFY FOR NEW Ph.D. QUOTAS

THE ENGINEER BRANCH has received some training requirements at the Doctorate level in Civil Engineering (Structures) and Geodetic Science. Interested officers with a master's degree in a related field should submit their applications prior to December 1, 1971. The application forms (1618-R) should, if possible, be accompanied by a letter of acceptance from an accredited university which states that an individual will be able to complete the degree in 24 months or less. Consult AR 621-1 for details or call the Branch Education Officer at OXford 3-032, Washington, D. C.

the Gap

10 ENGINEERS MAKE SELECTION LIST TO ATTEND ARMY WAR COLLEGE

SPECIAL CONGRATULATIONS are due to the 10 Engineers who were among the 100 active duty officers recently selected for enrollment in the Fiscal Year 1972 U. S. Army War College Nonresident Course. This is the only military correspondence course for which selections are competitive. Applications this year numbered well over 300; the highest since the program began in 1968. Graduates of the two-year nonresident course receive full credit for War College attendance, and are still eligible to attend the resident course. Details of application procedures are outlined in AR 351-11.

TIME BETWEEN VIETNAM TOURS IS INCREASING FOR COMBAT ENGINEERS

COMBAT ENGINEERS in Military Occupational Specialty (MOS) 12B and 12C have been assigned to involuntary second tours in Vietnam since 1967 to meet operational requirements. Currently MOS 12B and 12C Vietnam requirements are being filled by volunteers and personnel who returned from their first Vietnam tour approximately three years ago—in 1968. This is a marked improvement over the 20 month turn-around time which existed at one point during the Vietnam conflict. Even longer turn-around times may be expected in the future.

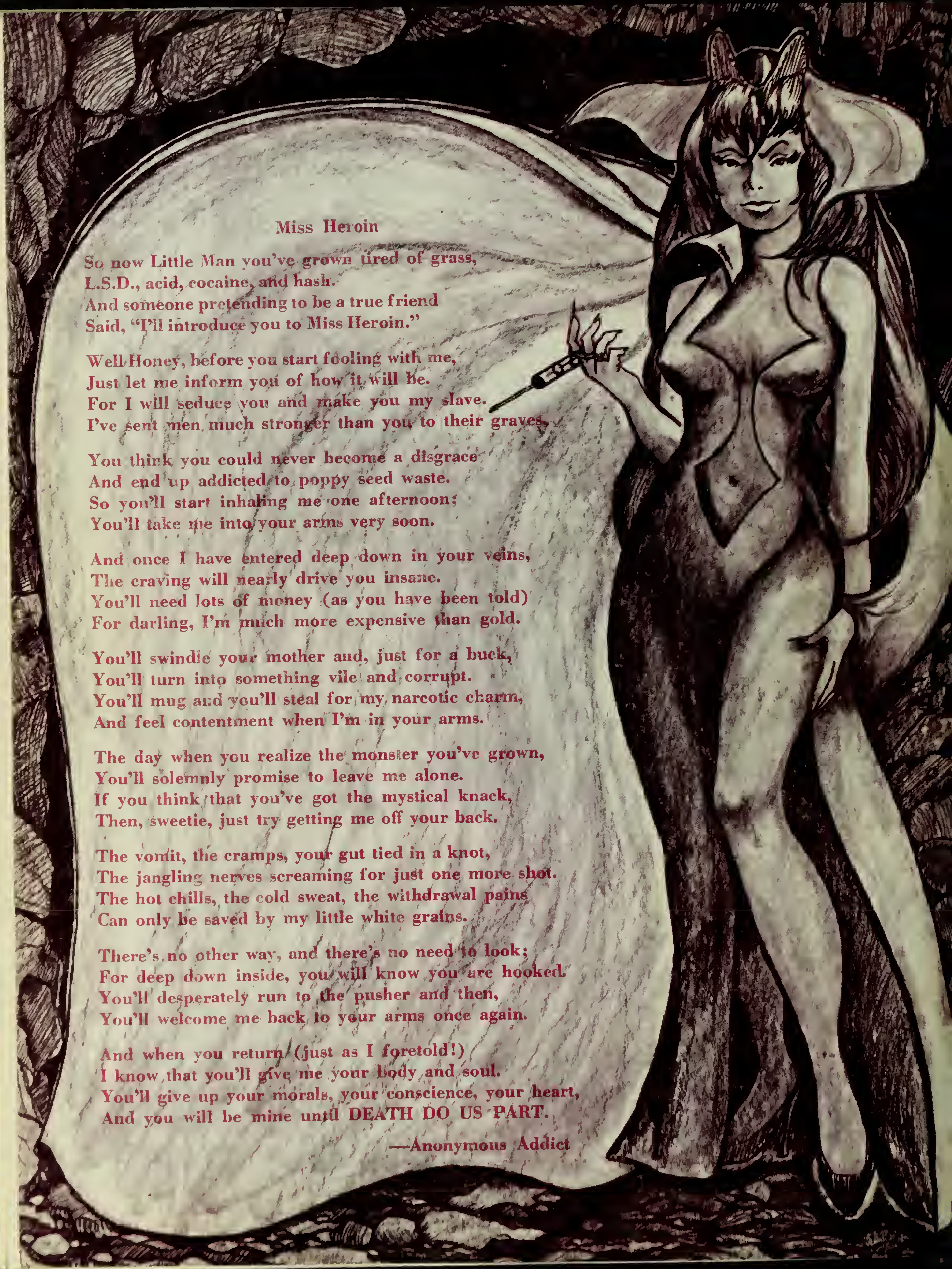
To give personnel in MOS 12B and 12C a longer period of time between Vietnam tours, the Department of the Army has made maximum use of MOS substitutions and of retraining other soldiers from MOS's that are less required in Vietnam. This not only increases turnaround time for combat engineers, but also gives other individuals valuable combat experience they would not normally receive.

ARMY INTRODUCES NEW TEST PROGRAMS TO CAREER EM

THE ENLISTED MILITARY OCCUPATIONAL SPECIALTY (MOS) Evaluation System has been expanded and is now more important than ever. In fact, many soldiers will not be eligible for promotion or reenlistment without taking one of the new Special Qualification Tests. The tests are in the same form as the regular MOS Evaluation Tests. Here are the requirements:

- To be promoted in an MOS other than the primary (PMOS), a soldier must take the Promotion Qualification Test. To take the test he will need his commanding officer's recommendation and a score of 100 or higher on his most recent PMOS. Procedures for Promotion Qualification Testing are contained in Department of the Army (COPA-EPPME) Message 221314Z dated June 1971.
- Anyone who desires to reenlist and does not have a PMOS evaluation score of 70 or higher in the last 12 months must take a Reenlistment Qualification Test. Procedures for this testing are contained in DA (COPA-EPPME) Message 141335Z dated July 1971.

These two special testing programs are aimed at further improving the quality of the enlisted career force. They also emphasize that MOS qualification is the responsibility of every soldier as well as his commanding officer and personnel office.



Miss Heroin

So now Little Man you've grown tired of grass,
L.S.D., acid, cocaine, and hash.
And someone pretending to be a true friend
Said, "I'll introduce you to Miss Heroin."

Well Honey, before you start fooling with me,
Just let me inform you of how it will be.
For I will seduce you and make you my slave.
I've sent men much stronger than you to their graves.

You think you could never become a disgrace
And end up addicted to poppy seed waste.
So you'll start inhaling me one afternoon;
You'll take me into your arms very soon.

And once I have entered deep down in your veins,
The craving will nearly drive you insane.
You'll need lots of money (as you have been told)
For darling, I'm much more expensive than gold.

You'll swindle your mother and, just for a buck,
You'll turn into something vile and corrupt.
You'll mug and you'll steal for my narcotic charm,
And feel contentment when I'm in your arms.

The day when you realize the monster you've grown,
You'll solemnly promise to leave me alone.
If you think that you've got the mystical knack,
Then, sweetie, just try getting me off your back.

The vomit, the cramps, your gut tied in a knot,
The jangling nerves screaming for just one more shot.
The hot chills, the cold sweat, the withdrawal pains
Can only be saved by my little white grains.

There's no other way, and there's no need to look;
For deep down inside, you will know you are hooked.
You'll desperately run to the pusher and then,
You'll welcome me back to your arms once again.

And when you return (just as I foretold!)
I know that you'll give me your body and soul.
You'll give up your morals, your conscience, your heart,
And you will be mine until DEATH DO US PART.

—Anonymous Addict

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the engineer

WINTER 1972

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the engineer

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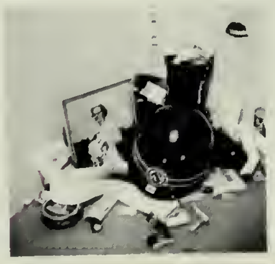

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CHIEF'S BRIEFS.....

Colonel Rufus Putnam, America's second Chief Engineer, was born at Sutton, Massachusetts, on 9 April 1738, and was apprenticed to a millwright at the age of 16.

He served in the French and Indian War from 1757 to 1760 under Colonel Richard Gridley—his predecessor as Chief Engineer—and after the Battle of Lexington was commissioned an officer of the line. When General Washington, who had discovered Putnam's practical engineering abilities, moved his Army south, he made Putnam Chief Engineer of his Field Army, and placed him in charge of the defenses of New York.

Colonel Putnam laid out the fortifications at West Point in 1778, and participated in the capture of Stony Point in November 1779. His work in the planning and construction of those defenses was quite notable, and Fort Putnam still stands to honor his name at the United States Military Academy.

In March 1786, along with other officers of the American Revolution, he founded the Ohio Company of Associates to purchase and settle lands to the west, and led the first great colonizing expedition to that area.

He and his fellow veterans reached "Putnam's Paradise," the present site of Marietta, Ohio, on 7 April 1788, and began the first organized settlement west of the Ohio River in what was then known as the Northwest Territory. Thus, the first great organized migration of settlers to the west was personally spearheaded by the United States Army's second Chief Engineer. The fortifications which he built there saved the settlements from annihilation during the disastrous Indian Wars.

Putnam's importance and authority increased. He was commissioned a brigadier general in 1792, and was directed to negotiate with the Indians for peace. Later, he was made superintendent of the river postal service from Marietta, and in 1796 was appointed Surveyor General of the United States, serving until 1803.

For his great contributions to its development, Colonel Putnam has been called the "father of Ohio." He died in Marietta—"Putnam's Paradise"—on 1 May 1824. ⊖

U.S. Army Engineer School
Fort Belvoir, Virginia

Commandant
MG Robert R. Ploger

Assistant Commandant
BG Richard L. Harris

Deputy Assistant Commandant
COL William F. Hart, Jr.

Officer-in-Charge
MAJ Tommy B. King

Editor
Robert G. McClintic

Managing Editor
William T. Spriegel

Executive Editor
CPT Dennis F. Pierman

Associate Editor
1LT Allen Sevier

Art Director
John W. Savage, Jr.

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ABOUT THE COVER

Rehabilitation of U.S. facilities in Germany as depicted by the scale model constructed by Art Director John W. Savage, Jr., is the theme for the cover of this issue. The engineers rehab effort is described in "Westward, Ho!" beginning on page 17.

Pipeline

ENGINEERS SALUTE CORPS AT ANNUAL DINNER MAY 5

The 105th annual Engineer Dinner will be hosted at Specker Field House, Fort Belvoir, Va., Friday, May 5, 1972.

Theme for the occasion is "The Corps Cares." The cocktail hour begins at 6:30 p.m. with dinner following at 8.

Entertainment will be provided during dinner, followed by a brief program, including presentation of the Itschner Award. The Society of American Military Engineers presents the award annually to the outstanding unit in the Corps.

The Castle Ball will be held the next night, Saturday, May 6, also at Specker Field House at 9 p.m.

Information for the events can be obtained by writing Chairman, Invitations Committee, c/o DPT-SEC Post Headquarters, Fort Belvoir, Virginia 22060. Or call A/C 703 664-1215 (AUTOVON Exchange 354-1215).

OCE NEEDS ASSIST IN PREPARATION OF CORPS HISTORY

The Office of the Chief of Engineers is writing the history of the Corps and needs assistance from the field.

Records and memorabilia of Army Engineers are needed, including diaries, photos, letters, biographies and personal papers of both military and civilian engineers.

For research collections, copies are needed of the Chief's Annual Reports from 1866 to the present, The Military Engineer from initial publication to 1921 and March-April 1936, Professional Memoirs, and Engineer School Occasional Papers.

Contact the Historical Division, Office of the Chief of Engineers, P.O. Box 1715, Baltimore, Maryland 21203—A/C 301 962-3250, Autovon 231-3890 (Ext. 3250).

ARMY TRACTOR CLEARS LAND FOR U. OF PANAMA

What started out as a routine evaluation of brush-cutting attachments of the U. S. Army's D7E medium tractor in a tropical environment developed into a civic action project when the University of Panama asked the U. S. military to help clear some heavy overgrowth from its research farm.

The cutting mechanism being tested—two drum rollers fitted with longitudinal cutting blades—is designed to clear land covered by secondary growth, but little or no heavy timber. The weight of the rollers can be increased by adding water or oil to the drums. A full-tracked medium tractor such as the D7E is needed to move the heavy rollers through underbrush.

Test plans for the brush cutter, one of five pieces of land clearing equipment being evaluated by the Tropic Test Center at Fort Clayton in the Canal Zone, call for completion of a 50-hour test mission in a humid environment.

TOPO MOVES TO UPDATE ITS MAPS

The US Army Topographic Command is anxious to provide all Army units the best possible topographic services, products and maps.

"However," Topo officials say, "it is difficult for us to improve present topo maps unless we get definitive information from the field pointing out changes, weaknesses or errors in maps now being used. At the Topo Command we must rely on each individual soldier to tell us how our maps can be made more accurate, more useful in the field.

"A soldier need not follow an elaborate procedure when he wants to give us some thoughts about topographic maps he uses. All he needs to do is jot down his ideas and send them (along with his return address for acknowledgement) to—US Army Engineer Topographic Laboratories, ATTN: Leroy Morkes, Geographic Sciences Division (TPCTL-GSA 86100), Fort Belvoir, Virginia 22060.

ENGINEERS AERATE TABLE ROCK LAKE TO SAVE FISH

To save valuable trout from suffocation, last fall U.S. Army Engineers began forcing oxygen into the waters of Table Rock Lake near Branson, Mo.

Ten large construction-type portable air compressors, were set up at Table Rock Dam and Reservoir a short distance upstream from Lake Taneycomo. Connected to the compressors by hundreds of feet of air supply piping, two large air diffusers, each measuring 80 feet across, were lowered to a depth of 185 feet n Table Rock Lake.

Cooler air temperatures each autumn reduce dissolved oxygen (D.O.) levels in Taneycomo below minimums believed necessary to sustain trout life. D.O. readings of ess than four parts per million (ppm), considered critical by the Missouri Department of Conservation, could result in a massive fish kill. The recommended level is six ppm.

Surface water, warmed by summer temperatures, has high dissolved oxygen content, while cold water at greater depths (to 230 ft in Table Rock Lake) has relatively low oxygen content. In the fall, surface water cools and sinks, displacing cooler water at lower depths, which has less oxygen.

Last October 1, two compressors began injecting air directly into the water that passes through two turbines of the dam's power plant. Biologists, engineers and technicians operate monitoring equipment at riverbank monitoring stations and in small boats above and below the dam. They record changes in dissolved oxygen content and other data, such as temperature and organic content.

With first tests of the aeration system D.O. content below the dam rose from four ppm to six ppm, indicating the experiment could succeed.

The project is considered important to the six million tourists, mostly fishermen, who annually visit the picturesque rolling mountain area surrounding Table Rock Lake and Lake Taneycomo.

Agencies working with the Corps of Engineers in the project are the University of Missouri, Missouri Water Pollution and Water Resources Boards, the Southwestern Power Administration, and the Environmental Protection Agency.

USACRREL FORMS NEW DIVISION IN ALASKA

The US Army Cold Regions Research and Engineering Laboratory (USACRREL) at Hanover, New Hampshire, has established a new division in the state of Alaska.

The Alaska Division will conduct and coordinate long-term research and technology applicable to Army engineering and environmental needs. With development of Alaskan resources, the Division will provide information on cold regions technology, environmental research and engineering for government and private agencies in the state.

Offices and laboratories of the Alaska Division to be located at Fort Wainwright, Alaska, will include the present test and support facilities of the USACRREL Alaska Field Station in Fairbanks.

ENGINEERS TEST NEW DISTRIBUTOR FOR DUST CONTROL

Army Engineers are testing the abilities of a new distributor to apply liquid dust-control materials and bituminous liquids on airfields, helipads, roads and storage areas.

The air-transportable vehicle is made in two sections which can quickly be coupled and uncoupled in the field.

A two-compartment tank provides a 375-gallon water capacity and a 2,000-gallon capacity for dust control materials. The distributor is capable of simultaneously applying water for preconditioning soil, fiberglass scrim for reinforcing, and liquid dust control materials.

engineer interview:

with

major general Howard W. Penney

and

brigadier general Carroll N. LeTellier

The war in Vietnam soon will be only a memory for veterans of that controversial conflict. The swift pull-out of U. S. forces continues and, eventually, approximately 50,000 Army troops are expected to remain to carry out logistics-type missions. So, the question comes to mind, where will the rest of our professional soldiers go? Home! Yes, but many will be reassigned sooner or later to Germany where the Army is focusing new emphasis and priorities.

To get a better understanding of the current and future role of the engineer in Germany, **the engineer** *visited installations and studied activities in that country for two weeks and interviewed Major General Howard W. Penney, USAREUR and Seventh Army Engineer, and Brigadier General Carroll N. LeTellier, Commander, U. S. Army Engineer Command, Europe.*

General Penney's offices are located in Campbell Barracks, Headquarters for U. S. Army Europe and Seventh Army. USAREUR staff sections have been housed in the imposing buildings of this kaserne in quaint old Heidelberg since the end of World War II.

General LeTellier's offices, on the other hand, are located in the new Engineer Command building just behind the I. G. Farben Building in downtown Frankfurt.

Both Generals Penney and LeTellier are veteran engineer officers. General Penney has been in the Corps for 31 years; General LeTellier 21 years.

As the Engineer for USAREUR and Seventh Army, General Penney has a unique position. He is the command staff engineer and reports directly to the Commander-in-Chief of USAREUR and Seventh Army. He receives technical direction from the Chief of Engineers for the command and funnels it to the Commanding General of Engineer Command, the commanders of the 130th Engineer Brigade in V Corps and 7th Engineer Brigade in VII Corps, and all other separate unit commanders in Germany, the BENELUX countries and SETAF. The only unit under his direct command line, however, is the USAREUR Topo Center.

General Penney is perhaps the epitome of the engineer officer. Very much the gentleman, he seems to

"We are trying to solve problems"

". . that require additional funds."

"We must develop innovative ideas."

have the steel-trap mind that looks at every problem with the cause and effect approach.

He has impressive credentials that should enable him to get any job done. The general is a 1940 graduate of the U. S. Military Academy and holds a masters degree from Texas A&M. He also is a graduate of the Command and General Staff College, the Advanced Management Program at Harvard University, and the National War College.

General Penney began his commissioned military career at the "home of the engineers," Fort Belvoir, Va., in 1940. He served at the Engineer School twice and held such positions at Supply Officer, Secretary, Assistant to the Assistant Commandant, and Assistant Director of Courses.

He has held a variety of top-level engineer jobs—Executive Officer of the Albuquerque District, Commanding Officer of the 20th Engineer Combat Battalion, Assistant Chief of Civil Works for Flood Control, OCE; District Engineer for Tulsa, and Deputy Director of Civil Works for Comprehensive Planning, OCE.

General LeTellier has moved swiftly up the ladder to the stars since his graduation from The Citadel in 1949. His credentials are many. But he needs them all to command the Army Engineer Command, Europe. As the commanding general, he is directly responsible for all new construction required by the three services in Germany and the BENELUX countries and for the maintenance, repair, and utilities services for all Army installations in Germany except Berlin and Bremerhaven. His command consists of some 19,000 military and civilian personnel with annual program values of approximately $185-million for contract and troop construction and design, and $205-million for Facilities Engineering (R&U) and family housing maintenance.

General LeTellier is one of the young new generals that will carry the Army far in the future. He is what most people would call a comer. He is enthusiastic, brilliant, and highly-qualified to handle the job at hand. His credentials include holding a masters degree from Massachusetts Institute of Technology, a graduate of the Armed Forces Staff College at Norfolk, the Navy War College and the Command and General Staff College.

The general has held a number of important engineer posts—Chief, Demolitions and Mine Warfare Section, USAREUR Engineer School Executive Officer, 299th Engineer Battalion, Engineer Project Officer for the Advanced Research Projects Agency in Saigon, Assistant Post Engineer and Doctrinal Officer, Combined Arms Agency, Combat Developments Command; Director of Construction and Deputy for Troop Operations, Engineer Command, Europe; Engineer XXIV Corps, Phu Bai, Vietnam, Commander, 45th Engineer Group (Construction) Vietnam, and Assistant District Engineer, St. Louis.

General Penney was interviewed first.

ENGR: Do you see any immediate or long-range changes in the European Engineer organizational structure?

PENNEY: No. The current structure with an Engineer Command under Theater Army Headquarters handling engineer combat service support, construction, and facilities engineering, has proven to be the best here.

ENGR: What are your top priority programs?

PENNEY: The rehabilitation of troop facilities, the upgrading of training facilities, and the revitalization of unit training in line with recent guidance from the Army Chief of Staff and the USAREUR commander.

ENGR: What is your biggest problem right now?

PENNEY: Lack of money to do critically needed rehabilitation of troop barracks, the rehabilitation of other facilities, and the conversion of heating plants from coal to oil.

ENGR: Where do you go from here with the thrust of your activities?

PENNEY: We are pushing hard toward solving the aforementioned problems with the available resources. We also are trying to get more funds and are increasing emphasis on realistic, effective, imaginative, meaningful training for all of our personnel.

ENGR: Do your units need new or better equipment to handle their missions?

PENNEY: We are able to operate with what we have now in the way of equipment. However, we could do a more efficient job if we had new equipment. Much of our equipment is old and tired, of low density, and consists of many makes and models. These factors create problems in keeping the equipment operational.

ENGR: Now that the war in Vietnam is winding down, do you anticipate large cuts in manpower over here?

PENNEY: I am not in a position to answer that question. I certainly hope not. Unilateral cuts would be a bad mistake in my view.

ENGR: Are the training and readiness programs still receiving top priority in their overseas area?

PENNEY: These programs are receiving high priority commandwide. Specifically, the engineers top priority for the next several months will continue to be barracks rehabilitation and associated projects—troop self-help, training area and rifle range upgrade. The best training an engineer unit can get is actual work on a project.

ENGR: Are there any moves to close down some of the kasernes where our troops are quartered?

PENNEY: Our Deputy Chief of Staff for Operations has the primary staff responsibility for development and restationing plans. There have been some relocations and consolidations of units for purposes of economy and to optimize positioning for mission support.

ENGR: Do you see the U.S. military forces focusing their attention on Europe now that they are pulling out of Southeast Asia?

PENNEY: There is a recent statement of priorities from the Army Chief of Staff where he points out that Europe can expect increased attention.

ENGR: Are you getting enough trained engineers to handle the mission in this command?

PENNEY: We have felt a recent increase in the input to the theater. We are getting a good share of the training base output. Our main problem is no longer numbers. We do have some Military Occupational Specialty and grade imbalances. We are presently overstrength in some MOS's (e.g. Grader Operator) as a result of the Vietnam drawdown while remaining understrength in others (e.g. Mobile Assault Bridge Operators). We are in good shape in the lower ranks, especially in the entry MOS's (e.g. 12A10, Combat Engineer), but need more Squad Leaders and Platoon Sergeants. This is a world-wide problem which creates an unfortunate skill and experience imbalance. We are tackling this problem locally by OJT programs to increase skill qualification as well as use of the Seventh Army NCO Academy and the Combat Engineer NCO course at the Vilseck Training Center. We also are using brigade level "Engineer NCO Academies" to develop our leaders.

ENGR: Do you have any OJT type training program in the construction skills?

PENNEY: Yes. Our battalions, both combat and construction, qualify soldiers by OJT to the limit of their capability. We also use the Labor Service/Civilian Labor Group organizations. These are German and third country nationals who are organized into para-military units—construction and float bridge. They are highly-qualified professionals and we periodically place U. S. soldiers shoulder-to-shoulder with them to improve our own construction and combat support skills.

ENGR: Is there any way you feel that the Engineer School could better assist you in training engineers?

PENNEY: The Engineer School does a magnificent job for the Army and I am really not in a position to make any suggestions for improvement. The school was most responsive to our recent need for output of ADM Specialists and we in USAREUR are very appreciative of that effort. I am heartened to hear that an Advanced NCO course is being established there. A successful course of this type should be a major step toward further improvement of our posture and skills in the supervisory grades.

Like the USAREUR Engineer, the Commander of Engineer Command, Europe, General LeTellier, has a monumental job. He is directly responsible for all new construction required by the three services in Germany and the BENELUX countries; and for maintenance, repair, and utilities services for all Army installations in Germany except Berlin and Bremerhaven. The general's command consists of approximately 19,000 military and civilian personnel with annual program values of some $185-million for contract and troop construction and design, and $205-million for Facilities Engineering and family housing maintenance.

ENGR: MAJ GEN Penney gave the magazine an extensive overview of the engineer structure in Europe. Do you feel that it is better set up to do the job than the Engineer Command, Vietnam?

LE TELLIER: I think our problems are different from Engineer Command, Vietnam. We do not have the immediate operational support requirements of field commanders. The engineer organization in Vietnam is tailored to respond immediately to the operational support requirements of the tactical commander as first priority. The residual force, both combat and construction engineers, not employed on operational requirements is utilized in the overall engineer construction mission. In Germany we are not in an active conflict and Engineer Command forces do not have a tactical support mission. The organization here is tailored to the European situation. The Engineer Command in Europe contains only construction battalions. Our peacetime mission optimizes the application of our construction troops, our in-house facility engineer works for this command to undertake the current multi-million dollar program to renovate the living and dining facilities of the USAREUR troop units to include renovation of the plumbing, heating and electrical systems while the troops continue to occupy these facilities. Our problem is complicated by having few accurate as-built drawings of the kasernes, most of which were constructed hastily by the German Government prior to World Wars I and II. Many unforeseen conditions are encountered which require contract modifications, while trying to maintain a tight contract schedule. Continuous coordination is required with the troop units by Engineer Command personnel to minimize these problems. We match our contract construction capability against the military construction requirements of the Army and the Air Force and the facility maintenance requirement of the Army in Germany. The combat battalions are assigned to the Engineer Brigade in the tactical corps. You probably know, Corps commanders are utilizing their engineers extensively in providing technical advice to their non-engineer units as well as in support of their construction programs to maximize the self-help program. However, the combat engineer forces are not assigned to the Engineer Command.

ENGR: You yourself have a very unique command and command structure. Could you give us more of an overview on the total mission of this command?

LE TELLIER: I think we could tell you the war-time mission of the command which is to provide construction engineer support to a conflict in Europe. This is in accordance with the normal doctrine to provide construction support not only to the Army but to the Air Force. This, of course, is a continuous planning problem. In addition to that we have a peacetime construction mission for the Department of Defense and all agencies in the Federal Republic of Germany and the BENELUX countries. Also, we have the responsibility for the maintenance of Army facilities for the predominance of the Federal Republic of Germany.

ENGR: Where do you go from here with the thrust of your command activities?

LE TELLIER: The command in its current form has been in being now just a little over four years and has undergone only one, relatively minor, internal reorganization. I believe our job now is relatively well defined. How do we do our job even better? We must now review our past, look at the future, and develop innovative ideas in order to make the dollar go further. This is obvious in our day to day operations. For example, in the administration of our O&MA program, the program managers of the troop, family housing, and the dependent school program all are operating on tight budgets and continuously demand more for their funds and minimum overhead charges. It is up to us to extend ourselves in construction area, the Engineer Command, Europe has a broader mission within the construction mission in accomplishing Army, Air Force, and Navy contract construction in Germany and the BENELUX countries. Also, the MACV Engineer is the CG, Engineer Command, Vietnam. In USAREUR, the USAREUR Engineer has broader area responsibilities outside the Germany and BENELUX area and does not act as CG, Engineer Command, Europe.

ENGR: How do you correlate with the Chief of Engineers and the Chief Engineer, Europe?

LE TELLIER: We are the recipient of the technical direction from the Chief of Engineers through General Penney, the USAREUR Engineer. Generally, our principal operational constrictions are received through fiscal program direction and the USAREUR Supplement to the ARs governing the Construction and Real Property Management Activities. I believe that it is interesting to note that there is quite a difference in the Engineer Command, Europe and the Engineer Command, Vietnam. The Engineer Command, Vietnam controls not only the construction engineer troops, but also the combat and topographic engineer troops. In Europe, the nondivisional combat engineer forces are controlled by the Corps and the topographic engineers are directly under HQ, USAREUR. In addition, in Vietnam, the DOD proponent for Construction is the Department of the Navy, whereas in Germany, the DOD proponent is DA. The Engineer Command, Europe and the Engineer Command, Vietnam both have the RPMA mission. Whereas the Engineer Command, Vietnam has broader responsibility outside the military order to maximize our effectiveness in this area.

ENGR: Does your office have any interdisciplinary communications gap with the field units?

LE TELLIER: To assume that there was no problem in this area would either require completely turning your back on a current problem or be a complete egotist and assume that the problem was solved. Though his command has suffered during the past several years due to personnel turbulence and understaffing, these two problems seem to be rapidly returning to normal. The settling of these two problems accompanied by the challenging nature of the command's current large number of projects should do much to provide all field units with a meaningful type workload which should promote pride in our organizations and reduce the current interdisciplinary communications gap.

ENGR: What is your biggest problem right now?

LE TELLIER: The greatest problem we currently face is coordinating our work with the troop units we support. Properly so, troop commanders are seeking two opposing objectives: maximum improvement of their facilities with minimum interruption of their organization operations. It is a real challenge.

ENGR: You are definitely covering your vertical skills in your construction battalion; how about your earth moving?

LE TELLIER: We are fully committed on our earth moving skills. Our horizontal capability has been fully utilized in about four areas. A. The Air Force has used a considerable amount of our capability on airfield construction and maintenance. B. As a result of our move out of France to Germany, TASCOM and the Air Force have had a large number of projects involving ammunition storage. C. The earth-moving units also have been involved in construction of hardstand areas for support of storing Reforger equipment. D. Finally, the change from the English system to the metric system has involved considerable amount of revamping of our firing ranges. While we have been doing this, the ranges have been upgraded to meet the current German safety standards.

ENGR: With the emphasis, or focus if you will, swinging from Vietnam to Europe, it would seem that you will be getting more dollars from the Defense Budget. This should alleviate your construction problems, should it not?

LE TELLIER: I hope so, but there is also the problem we are facing of installation costs here in Europe. I will cite an example of coal. The price of coal is forcing practically all of our utilities to go up. The cost of heating, and the cost of electricity are rising. Another interesting fact that has caused a rise in the cost of maintenance of the individual soldier's living area is the fact that we have just increased, not only the number of soldiers in Europe, but also the amount of living space assigned to each soldier. In the past we have had a DA objective of about 72 sq. ft. per man and now it is up to 90 sq. ft. per man. So we are maintaining, heating and providing electricity for more space per individual, we have more individuals and a greater cost to provide heat and electricity to that larger space. I might add that we are providing the individual with more electrical outlets for his hi-fi and other electrical equipment to make it in fact his home. No longer do we support the single 40 watt bulb in the middle of a 4 to 6 man room. So, the more our utility bills go up, less money is available to fund maintenance and repair.

ENGR: You talk about coal, the way we understand it they are converting the coal-heat to oil-heat. What will this do to the American dollar. It is our understanding that the coal is shipped over here from the States.

LE TELLIER: As you probably know, the oil is purchased centrally in the United States. The coal has been predominantly purchased in the States. However, coal has a further impact than just the heating aspects because the electrical power generated over here comes from German sources, principally produced from coal. The price of coal is reflected in the price of electricity. But back to the heating, it is a dollar and cents proposition. The fuel oil will be considerably cheaper because we can automate these systems much more readily than coal; therefore, we can considerably reduce the amount of manpower required to maintain coal operated boilers.

ENGR: Do you feel that our troops should be moved into newer kasernes rather than our trying to renovate some of the older ones that are in real bad shape?

LE TELLIER: It's a matter of purely dollars and cents. I think that the current climate of the country on military spending and the length of time necessary to fund a program to give all new facilities would be prohibitively long. I believe we are now taking the best alternative available to us; that is, to renovate what we have. It is the most economical course to provide immediate relief to the maximum number of soldiers.

ENGR: How long will it take for the engineers to get all of the living quarters, dependent, troop, and office, in first class shape?

LE TELLIER: It's purely a matter of appropriation. Let's take the troops' allowance total requirement for something like $200-million. Only about 20-25 percent of that appropriated money is in sight now. We could accelerate our program if we had additional funds. We have been working about four years on the program now. Based on the current appropriation rate and considering the work I think we are thinking in terms of a five to 10 year program.

ENGR: General LeTellier, now that you have your feet on the ground with a couple of months on the job, do you intend to make many changes in Engineer operations and in training programs within your command?

LE TELLIER: Yes, there are several changes underway which will have a major impact on Engineer Command operations and training, but to credit these changes to my observations over the last couple of months is improper. These changes were directed by General Kennedy, the previous Commanding General of this command, based on his observations over the last three years. To understand these changes, I believe we must understand the organization of this command. First, the organizational nucleus is that of a war-time Engineer Command, with a base of US Engineer Construction Troops and German Labor Service and Civilian Labor Group Construction Troops on which to expand to meet the theater war-time mission. Next we have the Facilities Engineer mission for virtually every US Army installation in Germany, which exceeds that of any CONUS Army; and finally we have the military construction mission for the Army, Navy, and Air Force for Germany and the BENELUX, which really is a combination of the military construction functions of both a Division and District Engineer in CONUS. We have recently made major changes in the operations and training of our US Engineer Construction Troops. In the past we have habitually deployed these troops to construction assignments during the prime construction season from March to November and undergone intensified maintenance and training during the winter months to meet the madatory requirements of the ATP. In line with General Westmoreland's new training policy as outlined in his letter of April 7, 1971, this intensified three month training program has been virtually eliminated. Due to the large backlog of projects primarily in the troop living areas, Engineer Construction troops have been assigned projects over the entire 12 months of the year. Since these projects include virtually every hard skill required for mission accomplishment, Battalion and Company Commanders will be responsible to schedule concurrent and supplemental training to fill the remaining requirements of their units. To hasten this development of hard skills, General Kennedy instituted prior to his departure, a program called, "Shoulder to Shoulder." This program involved the assignment of US soldiers to Labor Service/Civilian Labor Group projects to work with the master craftsmen of this outstanding organization, virtually as apprentices. Though there has been the expected language barrier, the program is a tremendous success. After about two months, the US soldiers have achieved the proficiency required to undertake a project of their own without outside assistance. Then finally, there have been some new innovations in the training of personnel in our Military Construction Program personnel. Last year, a team from Office of the Chief of Engineers, headed by General Daniel Raymond, at the request of General Kennedy, looked into the operation of the Engineer Command's Military Construction Program. As a result of this visit, the Engineer Command has been incorporated into the OCE Construction Evaluation Team's field visit schedule and also has been scheduled for classes from the OCE Military Construction Directorate's Field Training Team. It is desired that these actions will provide a procedure whereby the Engineer Command can keep abreast of the latest in CONUS construction procedures and management.

ENGR: What can the Engineer School do to help the mission of the Engineer Command?

LE TELLIER: In Germany, we have a requirement for masons, electricians, carpenters, welders and plumbers on our Stem-to-Stern and the Selective Rehabilitation of barracks and dining halls. We need well-trained, highly motivated soldiers in these hardcore skills for our projects. I think the movement now toward providing the Army skills some civilian status in the unions is certainly a step in the right direction in encouraging soldiers to refine and increase their skill level. They can have a future in the Army as well as in civilian life. The type of construction we are called upon to produce today requires a finished product, whereas in the recent past we needed only a rough product. We no longer need a soldier who is capable of making low grade cement, or possibly placing a rough slab. Now we may well need a steel trowel finish on a high strength slab. The skill level requirement of our artisan has increased and we have a tremendous construction program in Europe to apply these skills. Knowing that they are contributing to the overall welfare, not only of themselves, but of the Army as a whole is a definite help in job satisfaction. So we need well-trained, hardcore skills from Belvoir. One other area that I believe is of interest is that the Engineer School has for some years provided training for our Labor Service Group. This is one of the unique things about our Engineer Command. We have the 6970 Civilian Labor Service Group. Many of their officers and senior NCOs have been trained in construction management techniques at Ft. Belvoir. As a matter of fact, we have two individuals scheduled to go to Belvoir this year.

ENGR: Do you see any immediate or long-range changes in the command's organizational structure?

LE TELLIER: I suspect that the most direct answer to your question is, No. However, to one who does not understand this organization, such a direct answer is terribly misleading. The entire strength of this organization is built on its ability to respond to change. Five years ago the three primary functions of this organization were accomplished in three separate organizations with little, if any, mutual support. For example, the Engineer troops did little work in support of the Facility Engineers on O&MA projects; seldom did the operator of our facilities, the Facilities Engineer, provide advice to the Military Construction designers to insure current maintenance problems were rectified in new design; nor did either the troop units or the Facility Engineers fall back on the wealth of engineering and construction talent available in the Military Construction element. Now, the execution of the many different programs assigned to the Engineer Command are so interrelated that the above actions are commonplace. Fluctuations in workloads between programs (e.g., MCA & O&MA) can be balanced within the organization without the trauma of reductions in force or rapid increases in personnel. So in the light of the foreseeable future, the current organization appears to be quite sound.

Ein Sportplatz für Alle

ENGINEER STAFF

It won't be Casey at the Bat in Mudville, but it may be Heinz playing Goalie in Hirsau thanks to the efforts of the 78th Engineer Battalion.

When the construction of a new road destroyed the sportplatz (playing field) in the community of Hirsau, Germany, they found they could not afford to build a new one. So the Buergermeister of Hirsau asked the engineers for help.

The town purchased the land and hired an architect to draw up the plans. The job of the engineers, 14 strong, was to level and grade the land, placing fill to build it up where necessary, and to put the drainage system in.

Working from early in the morning until night, the men soon found themselves the center of attention. Crowds of children (aged 6 to 60) numbering as high as 40 at a time gathered to watch the two-ton earth movers and graders push and pull the dirt around for their new sportplatz.

Hirsau paid for the living expenses of the engineers and purchased all of the gas and oil. Still, the Americans were able to save the small town DM 160,000 (about $48,500), and at the same time boosted German-American relations on a grass roots level, soldier to civilian.

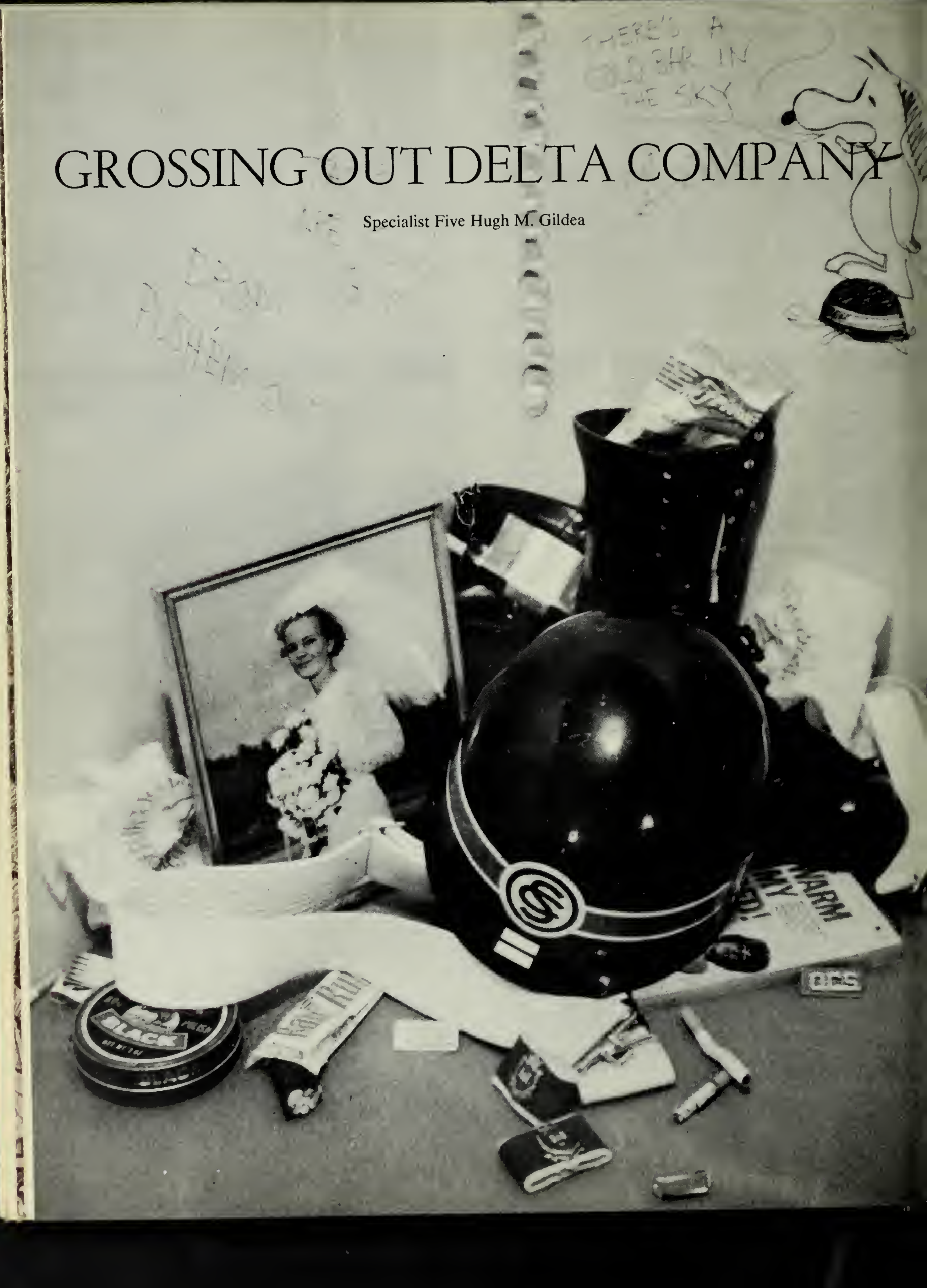
The engineers also used the opportunity to train new men to use the machines, while actually working on the job. The men said the training gave them a sense of satisfaction, because they knew they were accomplishing something. They knew the sportplatz was going to stay and be used.

By now the sportplatz is in use for soccer matches between local clubs and handball matches, and is being used by the schools. All made possible by the men of the 78th, American engineers.

ABOVE: A Hirsau lad salutes the troops. TOP RIGHT: Children of any nationality are always inquisitive. BOTTOM RIGHT: A front loader driver gives some German youngsters a "cooks tour" of his vehicle.

GROSSING OUT DELTA COMPANY

Specialist Five Hugh M. Gildea



An OCS dropout speaking candidly about the program asks, "Did you ever think of becoming an officer"?

Created during World War II, the Engineer Officer Candidate School trained over 25,000 commissioned officers for the Corps of Engineers. When the Korean Conflict began, Engineer OCS was reopened to provide 2323 new officers.

After an eleven-year lapse, the Engineer Officer Candidate Regiment was reactivated at Fort Belvoir, Virginia, on September 15, 1965. The school was again officially closed February 1, 1971, after 5 years, 4½ months. Of 15,380 candidates who attempted 'the program' in that time, a total of 10,380 had made it through the 23-week course to receive commissionsas second lieutenants, US Army.

For Engineer Officer Candidate School (OCS), the war is over.

The old 1800 area on Fort Belvoir's north post has been pretty quiet since the last class graduated just before Christmas, 1970. No longer does the air ring with rousing choruses of "There's a Gold Bar in the Sky," "California Dreamin'," and "The Whistlin' Gypsy." Gone are the harsh cries of "Drop candidate, drop! . . . Too slow. On your feet. Drop!—Now push out twenty." Barracks which held eight companies of officer candidates are now largely deserted. A few of the old buildings are occupied by clerks of the post's Adjutant General Division.

Returning to Fort Belvoir from Vietnam I was irresistibly drawn back to the Engineer OCS area. A scene of frenzied activity in the days when the program was in operation, today the former officer candidate site is as dead as our hopes for a quick military victory in Vietnam.

The candidates are all gone now, leaving behind only a few quietly deteriorating pioneer projects, rustic podiums and railings as evidence of the area's former glory.

Jumping inside one of the barracks so a passing private wouldn't see the moisture in my eyes, I was cheered by the flamboyant red and orange decor of the latrine, lovingly embellished by the final class with cartoons of Snoopy and his comic strip friends saying things like "Smack it in!" (your chin that is) and "Happiness is 19 November."

I lingered in the latrine until the private had passed, musing on the cryptic inscription on the wall, "Master of My Fate, Captain of My Volleyball Team." Then I stepped back into the autumn sunshine. For the Corps of Engineers, and for myself, an era had passed.

Before going any further, I will confess that I am an Engineer OCS washout, a hopeless "grossoid" in candidate jargon (one who grosses out, or makes mistakes frequently) who after eight weeks (in May-June 1969) was dumped from the program and returned to the ranks for an early visit to Vietnam. I would be first to admit that my efforts in the Officer Candidate Regiment met with limited success, and that I would not have been an effective combat leader by graduation time.

So with no alternative to Vietnam except Canada, I went, I saw, and if I did not exactly conquer, at least in that respect I was not alone.

Shortly after returning to Ft. Belvoir from Vietnam I appeared before a Soldier-of-the-Month board. The kindly gentleman who was chairman, after inquiring about my civilian background (BS in civil engineering with two years' field experience), popped the inevitable question. "Did you ever think of becoming an officer"?

Ah, indeed I had. For eight weeks I had thought about it nearly every waking moment of every day—and a good portion of most nights . . . often spent scurrying furtively around the barracks in the dark 'functioning' on a variety of ridiculous makework missions assigned us by our upperclassmen.

I still think about it from time to time, but no longer from the standpoint of personal advancement. Instead I am wondering if the training we received in the old Engineer OCS program really served the best purposes of the Army at a time when our country's military commitment stood deadlocked in a long and demoralizing war.

I wonder if all the functioning, dropping, grass-drilling, bracing, punishment-tour-walking, smacking-it-in and gutting-it-out really accomplished what the Army thought it should to the extent the Army believed it did. Or might some of that time and effort have been spent in better ways? In the hours I passed (and they did not just seem like **hours**) braced against the wall in the tactical shack waiting for counseling sessions, I could have made a good start toward learning to speak Vietnamese or studied *People's War, People's Army: The Viet Cong Insurrection Manual for Underdeveloped Countries.* I could have learned to disassemble an AK-47 or, more appropriately, the .45 caliber pistol. As I recall, the training schedule permitted an hour or so of instruction on characteristics of the .45 accompanied by live-firing of a couple of magazines on a range at Camp A. P. Hill. I don't remember anyone explaining how to aim the weapon effectively so if necessary a soldier could kill someone with it. The truth is it became far more important to have all traces of Brasso removed from your collar insignia than to know the operation of the officer's traditional weapon.

During the first eight weeks, contact with one's wife and family was limited to attending church together with a brief visit following the service (standing at parade rest) in the parking lot. An overnight pass was unthinkable; a candidate could look forward to a three-day pass about the 20th week (out of 23) in the program. The premise for such restrictions seemed to be that service as an Army officer often involves separation from your family, so you should get used to it right now.

Again and again we were offered the old combat-environment theory as justification for physical and psychological pressure. How well did OCS really duplicate a combat environment? In all our training no mention was made of the hutch maids, massage girls (in both Post Exchange-operated establishments and native enterprises), bar hostesses ("Hey GI! You buy me Saigon tea?"), bunker bunnies, sickaloe girls, and little Rest-and-Relaxation (R&R) friends the budding officer on a hardship tour away from his family might encounter. Needless to say, at Fort Belvoir no effort was made to simulate such aspects of the combat zone.

Nor was any guidance offered on how to deal with drugs, alcohol, hedonism, racism, loneliness, boredom, frustration with the system, indifferent civilians and reluctant draftees, easy money, ready vice and crime that plagued an officer in Vietnam, both as a leader of men and as an individual. Virtually nothing was taught about the Vietnamese or the Viet Cong. After all, each man DID get three days of Republic-of-Vietnam Training before shipping over.

"An officer's word is his bond," we were told. Our lives were governed by an Honor System which attested that a candidate did not lie, cheat or "quibble." Our lives were also governed by numerous regulations, including many which were contrary to tasks we were expected to perform. One regulation stated a candidate was to be in his bunk from 2200 hours until 0530 hours. At 0535 of course he was expected to burst from the billets fully dressed, booted and shaved with all nocturnal tasks completed.

A candidate did not lie, cheat or quibble, but he was expected and encouraged to exercise all his ingenuity to circumvent any regulation or other official obstacle standing in his way. Whatever a man did was all right it seemed, so long as he did not get caught.

For example, every class had its "official" parties which every candidate attended. A certain regulation prohibited the "slush funds" used to finance these and other functions. Much furtive collecting, secret accounting codes and midnight bookkeeping was therefore required so that on the night of nights the hall would be rented, the booze provided, and the band would be playing merrily—(to everyone's astonishment). The successful candidate became most adept at being "sly, cunning and alert."

At the foot of each candidate's bunk, his bookcase of Army literature contained training manuals on rules of Land Warfare, treatment of Prisoners of War and Civilians in a Combat Zone. The average man rarely looked at these or the other manuals. With all the "functioning" required of a candidate, he found few occasions for idle curiosity. Besides, he really did not need to study superfluous material. Classes designed to make him "technically and tactically proficient" were heavily studded with "teaching points" to indicate similar questions would be found on the quiz.

This is not to say that the quality of instruction was not quite high. It was, and often we met instructors who presented their material admirably. But I observed that a majority of the candidates were so "smacked in"—tense, distracted and fatigued—they neither absorbed nor remembered much of the instruction for long after each exam.

No comprehensive examination at the end of the 23 weeks determined whether a candidate was as "technically proficient" at tying bowlines and clove hitches as he had been when the helpful old sergeant on the rigging committee was guiding his hands.

I could go on and on, reminiscing about the program . . . about how in lieu of punji stakes we effectively crippled ourselves with the "Corcoran bite" of our spitshined jump boots . . . the switch-around-switches, poagy bait (surreptitious food) runs, being "Nuked" by the upperclass (afterwards the barracks' interior looked like it was hit by a nuclear explosion), honor council hearings, and so on and on . . .

But no more war stories. As I said at the beginning, for Engineer OCS the war is over.

I would not deny that some very fine officers emerged from EOCS. They did. Above average and adequate lieutenants also were graduated, along with some who were mediocre and a few duds. But I do believe that some very obvious improvements in the program could have made the best of Belvoir's OCS graduates better officers, more able to meet demands of leadership.

Now that EOCS is history we can judge it more objectively than when we were immersed in the program as candidates or as cadre. But if the school no longer exists, why debate its merits now?

Since World War II, OCS at Fort Belvoir has been reactivated twice, to supply officers for the Korean war and for Vietnam. Will it be reborn again to meet some future world crisis? . . . In the Middle East, Africa, South America, or again in Southeast Asia? Perhaps even in our country events might create a need for quickly-trained engineer officers . . .

My message is this. If the United States Army does not judge the training of officers we followed in Vietnam with today's perspective on our experiences there, what mistakes made there will we see repeated in some future conflict?

If you are staying with the Army, you might find yourself with the job of starting up that program again . . .

Not me, though! Soon I will be stacking arms and returning to civilian life. But I will always remember Engineer OCS. And at that final reveille formation on high, should the great commanding officer pause in the course of his in-ranks inspection to ask if I ever though of becoming an officer, I will smile and say, "Yes, sir," fondly remembering grossing out Delta Company in the days of the Old Program! ⊖

Specialist Five Hugh M. Gildea, a graduate of the University of Virginia, works as a clerk in the Personnel Services section of the Adjutant General Division, Fort Belvoir, Virginia.

This is the first in what we hope will be a series of articles dealing with subjects that, although controversial, are of concern to all Army Engineers. *The engineer* staff hopes that these stories, contributed by our readers, will serve the mission of your magazine as "an open engineer forum."

Specialist 5 Hugh Gildea's thoughts about the OCS program are certain to simulate a reaction among those who attended, taught, or otherwise viewed the program. In printing these provocative observations, *the engineer* looks for remarks from the field. Comments from our readers in response to this discussion are welcome. Contributions on other pertinent topics are also solicited. We reserve the right to edit material submitted, for purposes of publication, space limitations, etc.

This article does not necessarily represent the opinions of the Department of the Army, Fort Belvoir, or The Engineer School.

The enemy was nature!

A flood swirled over much of Montgomery County on the outskirts of Philadelphia recently and caused major problems for the area. Citizens were having a difficult time clearing the wreckage themselves until the county commissioners asked for help from a professional source.

The help came quickly from the 365th Engineer Battalion (Reserve), headquartered in Schuylkill Haven (Pa.). Two Companies, B and D, both assigned to the Reading U. S. Army Reserve Center about 35 miles from the flood scene, received the mission to assist in the cleanup operation.

THE TWO COMPANIES were able to clean up most of the debris in just one weekend. Working in around-the-clock shifts, they opened parts of Skippack Creek that was blocked by uprooted trees and an overturned steel truss bridge. The engineers used cutting torches to slice the macadam roadbed of the bridge into sections and hauled it away with bulldozers. Debris also was removed from the area of two other damaged bridges—Germantown Pike and Cedar Lane. Both companies were able to work throughout the night by using floodlights. Their command post was located at Evensburg State Park Headquarters and the bivouac and mess facilities were provided by Methcaton High School near Collegeville. Personnel slept in the school gymnasium and ate two meals in the cafeteria. Other meals were served at the job sites.

The operation was called a success by both engineer officers and the county commissioners. It proved that engineer Reserve units can do the job in a given situation. But it also gave the members of the 365th a chance to make first-hand use of their training and provide much needed help when and where it was sorely needed.

OPERATION CLEANUP

ENGINEER STAFF

This soldier cuts the distended bridge into sections so cranes or winches can haul them away.

This member of the 365th Engineer Battalion (Reserve) heads back to the creek with his front-end loader to haul more debris from the flood-ravaged creek.

These two bulldozer operators use their vehicle to push flood debris from Skippack Creek, northwest of Philadelphia. More than 200 reservists of the 365th Engineer Battalion participated in "Operation Cleanup."

WESTWARD HO!

Robert G. McClintic
Editor, the engineer

"THE TROOP ENGINEER MUST HAVE LABOR AND TRANSPORT WITH WHICH TO DO HIS WORK, AND BE PROVIDED WITH A HORSE TO INSPECT ITS PROGRESS. HE MUST SERVE MANY AND ACCOMPLISH MUCH WITH LITTLE, YET, SINCE HE CANNOT DO EVERYTHING FOR ALL, HE IS BELOVED BY NONE." *KING CHARLES I (1600-1649)*

The U. S. Army is looking Westward again!

With the slowdown of the war in Vietnam and the gradual drawdown of our Armed Forces from that turbulent country, the Army is once more focusing renewed emphasis on the continent of Europe; particularly Germany.

Although our Army has been holding forth in Europe since the end of World War II, the "hot" war in Vietnam caused a swing in the emphasis pendulum—money, troops, and thinking—to Southeast Asia about five years ago.

This has produced a number of perplexing problems for our Germany-based headquarters—U. S. Army, Europe (USAREUR)—which has been a major force in the North Atlantic Treaty Organization for many years.

The USAREUR buildup in Germany began in earnest 20 years ago as a deterrent to aggression from the East and it still has the same mission. But there has been little money and poor troop stability in that country since the Vietnam conflict mushroomed into a major war.

The Army looked to its forces in Germany for leadership, professionalism, and combat security following World War II and following the Korean War, and is looking at them again today as the acrid smell of gun powder begins to lose its sharpness in the Vietnam air.

The basic mission of our engineer units in Europe has not varied through the years. The 20 battalions and 23 separate companies have been stationed in Germany primarily to support the U. S. elements of NATO. When required, they also have the capability and the mission of supporting the military forces of our allies.

The engineer command structure in USAREUR is unique. It breaks out this way. There are two combat brigades—the 130th and the 7th—assigned to V Corps and VII Corps, respectively. The other major unit, the 24th Construction Group, is assigned to Engineer Command, Europe. The command line is decentralized in that the brigade commanders report directly to their corps commanders; the commander of the 24th Group reports to the Commanding General of Engineer Command; and he, in turn, reports directly to the Commander-in-Chief of U. S. Army, Europe. The USAREUR engineer—a two-star billet—is not directly in the command line. However, he also reports to the CINC, USAREUR.

Intensive combat support training such as tactical bridging, line of communication bridging and demolitions work has been continually conducted by the combat engineers. They must maintain these proficiencies if they are to be combat-ready.

On the other hand, our USAREUR construction engineers have emphasized a two-fold training role. Full emphasis is placed on funded projects that support facility needs during good construction weather. When the weather is bad in the winter, the emphasis shifts to tactical combat-type training.

Today, however, with the priorities swinging back to USAREUR, the engineers training role is undergoing a major change. Most of the training mission will be devoted to special projects—the rehabilitation of U. S. occupied troop billets, mess halls, dependent housing, and offices. This on-the-job type of training mission will create many challenges. The problems are many too.

But perhaps the command's greatest problem is time. USAREUR needs time to get its house in order if it is to meet the demands that will be expected of it in the early seventies. There will be additional manpower, additional modern equipment, and additional funds to improve facilities.

The crux of how well USAREUR will do, however, lies in a single word—improvement. The sad fact is that the troop billets, mess halls, dependent housing, and offices occupied by our forces stationed in Germany have badly deteriorated in the last 10 years.

Most of the military kasernes (posts) in that country

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HOLD SUCCESS USAREUR PLANS

Engineer troops face a challenge of major proportions in USAREUR. It will not be easy for them to fulfill the needs of the Army in Europe in the years just ahead. They are involved in helping paint a new image for the U. S. soldier in Germany. The first coat is still undergoing the brush. They recently built this hardstand atop a hill in Bavaria (left photo, page 18); are helping build this structure that will house U. S. personnel soon (center photo); work on the interior of their barracks (top photo, page 19); and had a hand in completely renovating this troop washroom and shower (bottom photo, page 19).

were built before World War II; some before the turn of the century. This means that sanitary facilities are antiquated and many of the heating and lighting systems are unsatisfactory.

Rehabilitation of the barracks and the mess halls is closely tied into the USAREUR Volunteer Army plan. The rehabilitation must be done quickly to handle the expected boost in troop strength. Many of these troops will be volunteers who are enlisting for Germany because it has always been a choice duty assignment.

The USAREUR Engineer, Major General Howard W. Penney, says the rehabilitation program breaks down into three priorities—1.) barracks and mess halls, 2.) dependent housing and 3.) offices. He estimates that it will take five years to completely rehabilitate the 165 kasernes which house our troops in Germany. However, much has already been accomplished and much more is currently being done to alleviate the problem.

Our Germany-based engineers are approaching the problem through three programs—Stem-to-Stern, Self-Help, and Selective Rehabilitation.

Stem-to-Stern was launched in Fiscal Year 1968 when funds were very tight but it has produced results. Under this program, the troop living and messing facilities of one kaserne at a time are completely refurbished with modern heating, plumbing, electrical systems, floors, windows, stairs, painting, plastering, and roof restoration. The Stem-to-Stern goal is to renovate barracks in 120 of the 165 kasernes at an estimated cost of $200-million. Our engineers in Germany (through Fiscal Year 1972 funding) will have modernized or are in the process of completely renovating 26 kasernes at a cost of $60-million under Stem-to-Stern. The remaining work will require an additional $167-million. The survey and design of an additional 21 kasernes has now been accomplished under the program. This represents a great deal of improvement but about 100 kasernes still will require extensive renovation to bring them up to decent standards.

Self-Help also is a realistic program. Under this plan, personnel from non-engineer units do work on their own billets that does not require a high degree of special skill. Supervised by engineer personnel, these soldiers install glass, repair faucets, doors, floors, and paint.

The other program, USAREUR engineers have launched to get the renovation job done is called Selective Rehabilitation. This is a piecemeal program which involves renovating sanitary facilities in the troop billets, modernizing mess halls, and repairing the heat-distribution and hot-water systems in the kasernes. Selective Rehabilitation is used in emergencies—cases where the work cannot be delayed for full Stem-to-Stern work to be funded. It is also used in kasernes that are not earmarked for the Stem-to-Stern plan.

The actual barracks and mess hall rehabilitation work is being accomplished by civilian contractors, engineer units (both construction and combat) Self-Help troops, and by 24-man Utility Teams on six-month TDY from the states. It works this way. If a kaserne has 20 barracks which need renovation, the construction work is broken down into four phases so no more than five buildings will be vacated at a time during any one phase of construction.

Stem-to-Stern has been continuously refined over the past three-year period. One of the engineers' primary objectives has been to provide durable buildings, capable of withstanding heavy troop use. Each year construction mistakes that surfaced were studied and alternate methods were used the following year. This principle has brought about a number of construction improvements. For example, follow-on actions from alternate methods have introduced Frenzelite-type ceilings for shower rooms, stainless steel lavatories, fluorescent fixtures, shower room benches, improved shower and sanitary area ventilation, and improved quality control of materials. Engineer efforts also have improved the European application of U. S. standards in mess hall design and functional use of barracks.

But even with all the accomplishments, our engineers in USAREUR are facing a serious related problem. There is an immediate need to convert coal-fired boilers to oil. Only solid and liquid fuels are used to heat water and buildings in Germany. Most of the boilers that produce the heat and hot water are coal-fired. They are old, undependable, expensive, and are swiftly wearing out.

Overall conversion of the coal to oil program is still in limbo because there has been no authorization and appropriation to cover it in the military construction budget. Current USAREUR directives, however, do permit the replacement of coal-fired boilers that fail during the current heating season.

The remaining boilers in the same plant may be converted only if safety considerations and operational or construction costs preclude using a dual plant.

But this is not enough, according to USAREUR engineers. They argue that existing restrictions which block the conversion of USAREUR's heating plants from coal to fuel oil must be removed without delay. Engineers feel that the inability to complete the conversion program will have the following adverse impact—

- Unreliable and inadequate heat and hot water services for the U. S. Forces in Germany.
- Continuation of high fuel charges since coal costs twice as much as oil for the same amount of heat that is produced.
- Continuation of high labor costs.
- Unreasonable installation costs through piecemeal conversion.
- Increased fuel storage installation costs, since coal and oil must be stored separately when plants are operating on dual fuels. Also, special parapet walls must be constructed as a safety measure under the dual plan.

General William C. Westmoreland, Army Chief of Staff, recently told a Senate Appropriations Subcommittee that U. S. units stationed in Europe have been forced to operate on extremely austere funding in recent years and the effects have become painfully apparent.

He said, "Many of our soldiers in Europe are living in old German barracks, most of which were built many years ago. Many are in disgraceful condition because they have not been properly maintained for years, due to the expense involved. German troops in the same towns are living in modern barracks. I find that our soldiers sometimes pay for essential barracks maintenance out of their own pockets rather than accept these conditions."

Assistant Defense Secretary for Installations and Logistics Barry J. Shillito also has gone on record as a strong advocate for improved troop housing. He claims it is one of the most important requirements to persuade servicemen to make the Armed Forces their life career.

Mr. Shillito says the Defense Department believes "implicitly that improved housing will provide both immediate and long-range benefits through increased reenlistment, heightened morale, and reduced recruitment costs."

The U. S. Army Engineer Command, Europe, has launched a unique craftsmen apprenticeship program called Shoulder-to-Shoulder that also should augment the rehabilitation program.

The troop element of Engineer Command consists of the 24th Engineer Group (Construction) and the 6970 Labor Service—Civilian Labor Group (LS-CLG). The 24th Group is made up of four construction battalions and one construction support company that provide specialized heavy equipment to reinforce the battalions and the LS-CLG companies as required for special tasks.

All three LS construction companies are constituted from third country nationals, mostly displaced persons from World War II. On the other hand, the four CLG construction units are manned by artisans and engineers who are primarily German Nationals.

Engineer Command has been able to integrate the forces of U. S. military, U. S. civilians, German Civilian Labor Group, multi-national Labor Service units, and German National employees (including many personnel from other countries such as Spain, Italy, Turkey, Greece, Ethiopia, Australia, Great Britain and others) into a harmonious working group. It provides con-

REFORGER REFLECTS READINESS

USAREUR's largest field training exercise is Reforger. During this FTX, The U. S. redeploys dual-based stateside Army units to Europe where they are placed under NATO control. As the photos on these two pages depict, engineers play a major part in the role of the plâyer forces during the exercise. This FTX is classified as a full-scale assault so the engineers normally show their flexibility by establashing a bridge, performing reconnaissance, clearing roads and impasses, and supporting classical infantry-tank combat attacks on an enemy force. Reforger III was held in its usual maneuver site again last October—deep in the Bavarian countryside.

60
CAUTION

struction and real property maintenance in support of the following programs—Military Construction Army (MCA) to include further program subdivisions into family housing and U. S. dependent schools, Military Construction Program of the Air Force (MCP), Military Construction for the Navy and Coast Guard, Operating and Maintenance, Army (O&MA), Non Appropriated Fund (NAF), NATO Infrastructure Program, Alternate Construction Program with the Federal Republic of Germany, and Procurement of Equipment and Missiles, Army (PEMA).

The uniqueness of the work force and the diversity of the types of construction from multiple funding programs give this organization great engineering capability.

The U. S. units have a history of being extremely competent in earth moving and paving (horizontal construction) while the LS/CLG units have been manned with skilled artisans in the building trade crafts such as carpentry, masonry, plumbing, and electrical installations.

So, the Engineer Command has paired U. S. personnel with their more experienced civilian counterparts to learn some of the various job skills. This program has benefited both the Army and the individual.

USAREUR headquarters sees it as an imaginative training vehicle that offers more professionalism in the trade skills. In an attempt to capitalize on the morale and motivational aspects of the program, efforts are currently under way to give participants a special certificate of achievement upon satisfactory completion of their apprenticeship. USAREUR also is investigating the feasibility of obtaining trade unit certification in Germany. It would be similar to the proposal now being undertaken by the Engineer School with the U. S. trade unions.

In this regard, the commander of Engineer Command, Europe, Brigadier General Carroll N. LeTellier, says, "Here in Germany we are now utilizing the four related skills of mason, electrician, carpenter, and plumber on the Stem-to-Stern and the Selective Rehabilitation programs where we need well-trained, hardcore skills for our projects.

"I think the movement now toward getting professional trade credit from the unions for Army skills is certainly a step in the right direction in encouraging these young men to refine and increase their skill level. They can have a future in the Army as well as in civilian life.

"One program that I think is interesting which the Engineer School is providing for us—and has for some years—is training members of our Labor Service Group.

"This is one of the unique things about our Engineer Command. Many of the officers and senior NCO's of the 6970 Civilian Labor Service Group have been trained in construction organization techniques at Fort Belvoir. We currently have two men scheduled to attend school there this year."

USAREUR will use the various programs and personnel to get the job done as quickly as possible. Of course, while most engineer units will be primarily concerned with rehabilitation and boiler conversion in the coming months, there are many other projects that cannot be ignored.

Elements of the two combat engineer brigades and some of the separate companies will continue to conduct intensive combat support training. These units still will be involved in field training such as hasty gap crossing, barrier construction, river crossing, and air movement operations.

Both of the combat engineer brigades and the Engineer Command have been and will continue to be engaged in the many other construction projects in Germany. These include—expansion and development of roads, railroad sidings, tank trails, storage areas, hardstands, athletic fields and known distance ranges; assemblying prefabricated school buildings for dependent school children; operating rock quarries; operating percussion well-drilling rigs; building helipads, and building or improving airfield runways.

It is a fact that Engineer projects in Germany are

many and are varied. One that has not been mentioned is the annual field training exercise (FTX) Reforger. This is the largest FTX our Germany-based troops participate in each year. During the FTX, the U. S. redeploys dual-based Army units stationed in the United States to Europe.

Reforger III was launched last October in the U. S. maneuver area in Bavaria. Some 11,000 troops redeployed from Fort Riley, 16,000 U. S. soldiers stationed in Germany, 2,800 Canadians, and 3,000 Germans made up the entire complement of NATO forces.

Engineers had more than a passing interest in this important field exercise that was held under the watchful eyes of the Army Chief of Staff and distinguished visitors from the U. S. and allied countries.

Our engineers were called on to recon roads and bridges in the maneuver areas; establish a railhead; prepare the exercise Highlight site; and be a vital part of the Highlight. They were expected to establish a bridge to allow for a successful penetration of enemy forces; be ready to support the crossing of four major rivers in the maneuver area; reinforce the combat engineer capability of player forces; provide potable water for nearly all participating forces; act as umpires to check the proficiency of fellow-engineer participants; and to coordinate the control, reporting and repair of maneuver damage throughout all unit assembly and the extensive maneuver area.

Some 50 members of four engineer companies made surveys of the "battle" area before, during, and after the exercise. Survey results will determine the reimbursement Germans may receive from the respective NATO countries for property damage caused by the field exercises.

Now, with all these projects and more aborning, the immediate challenges and problems facing the USAREUR engineers will not go away. They have an enormous task ahead. Much of the success of the Volunteer Army program in Germany, of course, will hinge on the overall success of the engineer effort.

The USAREUR and Seventh Army Commander-in-Chief Michael S. Davison says his sweeping improvement program could set an example for the entire Army in the crucial seventies. He sees USAREUR as a foremost leader in NATO, the U. S. Army, and the Defense Department in the coming years. The strategic location of the command may help make this prophecy come true. The engineers role in Germany also will have a great bearing on the eventual outcome.

The engineer surely will improve the USAREUR image through this new rehabilitation program. Time, labor, and money are the must ingredients if the recipe for rehabilitation is to be a success. Labor and money will be available but USAREUR's engineers may have a problem getting enough of the other ingredient mixed into the batter on schedule. e

A REVOLUTI
ENLISTED C

A new approach to enlisted leadership will be unveiled at Fort Belvoir's Engineer School this month as the new Engineer Noncommissioned Officer Education System (ENCOES) shifts into high gear. It is part of an Army-wide revamping of its program to foster the educational development of its NCO's.

From July 1968 to December 1969, the Department of the Army and the Continental Army Command (CONARC) were involved in the proposal and planning of the new Noncommissioned Officers Education System (NCOES). The resultant letters of instruction to CONARC branch schools (i.e., armor, artillery, engineer, infantry, etc.) identified three progressive levels of instruction as basic, advanced and senior, the first two of which were implemented as pilot courses at the U.S. Army Engineer School at Fort Belvoir, Virginia, in July 1970 and May 1971, respectively.

The requirement for an NCOES is related to recently identified needs for more effective leadership at all levels in the "new" Army. The key man in the management structure, because he either controls or directly supervises 80 percent of the Army's personnel resources, is the noncommissioned officer. It is upon his abilities, technical knowledge and application of basic leadership tenets, that his individual success, and the success of a modern Volunteer Army, is contingent.

The noncommissioned officer has always been the "backbone of the Army." His needs for progressive, professional development, however, have often been overlooked because of unrealistic emphasis on the experience factor—and in all too many cases, the NCO's with the greatest potential have been kept out of even the local NCO schools because command interest has been heavily slanted toward the mission. Hopefully, the All Volunteer Army program with its emphasis on enlightened leadership and professionalism throughout the ranks will help to eliminate short-sightedness and allow an innovation such as the NCOES to realize its potential.

While the informal approach of on-the-job training (OJT) is recognized as the most expeditious means to

ONARY FORMULA FOR AREER DEVELOPMENT

Major Robert E. Harper

the end of developing some highly technical job skills, it is also apparent that it does not meet the need for progressive and continuing formal education of career enlisted men. The increasing complexity of equipment and expanding responsibilities of supervision, as well as the unique leadership problems inherent in an all-volunteer Army, necessitate a drastic and immediate change to the OJT approach. Emphasis on a program of continuing formal education not only in professional military considerations, but also in civilian educational endeavor beyond the high school level is an apparent panacea.

The pilot courses at the Engineer School have provided an interesting study of the capabilities and educational needs of Engineer NCO's. They have generated ertinent observations, vital student feedback and local, rofessional expertise which have been employed in development of the "second generation" NCOES which tarts this month.

Not meant to be an inflexible program with cast-in-oncrete subject matter and methods of instruction, the urriculum and teaching vehicles will be variables in he educational equation, changing with the Army and he student. The objective of the program, however, is ot likely to change. As a matter of policy, it will begin nd continue to provide the Engineer NCO with guidance and expertise that promotes leadership, encourages roader knowledge of Military Occupational Specialties MOS's) and provides low-liability exposure for the tudent to the responsibilities of leadership positions nto which he will be promoted in the future.

At a primary or basic level junior enlisted men will e given the opportunity to find answers to the question "Do you think you could do the job better than your quad leader or platoon sergeant?" At the second or advanced level, NCO's with a little more experience under heir belts will entertain the same question as applied to hat old "First Shirt" or Sergeant Major, who really do eem to know it all. At the senior level, successful supergrade Engineer NCO's will be exposed to the sophisticated problems and responsibilities of top staff and command positions, much as their commissioned counterparts are at the Command and General Staff College at Fort Leavenworth, Kansas. This is no simple "spit and polish" local NCO academy. It is part of a new and highly sophisticated system designed by the Department of the Army to provide the non-commissioned officer with an unparalleled professional education.

On the surface, the task of providing a progressive career educational program for enlisted men with 36 different engineer-related MOS's seemed monumental. The pilot courses at the Engineer School, however, enabled school cadre to develop a program of instruction

whose basis is flexible enough for application to both Basic and Advanced NCO courses, accommodating all engineer-related management fields and MOS's in four distinct phases.

Phase I is designed much as the lecture period of a laboratory science course in college, with students lumped together for discussion of universal leadership topics such as professional ethics or military resource management. It is beyond this point that ENCOES becomes tailored to the individual.

Phase II necessitates a breakdown of the class according to individual career field patterns whose subject matter is, by definition, more specific. Presently there are five such career fields.

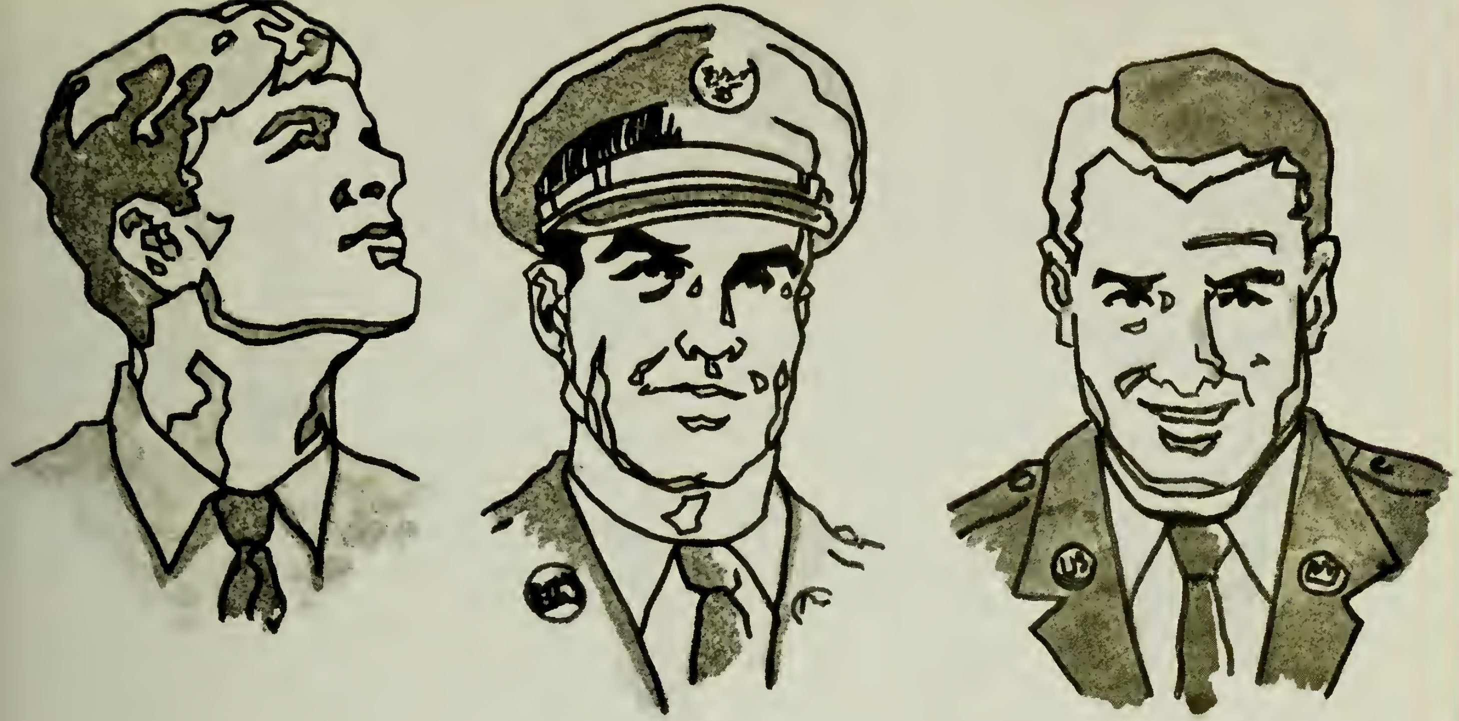
- Combat Engineer
- Construction and Utilities
- Engineer Equipment
- Mechanical Maintenance
- Topographic

Phase III is devoted to MOS specialization, with emphasis on increasing skill levels within "target" MOS's. Target MOS is defined as that MOS with the 40 or 50 skill digit to which the student's own MOS career pattern leads.

Phase IV consists of specialized group and individual projects where the student is required to make practical application of the skills and knowledge to which he was exposed during the preceding three phases of instruction. Consistent with Phases II and III, the length of Phase IV is variable and established according to the changing needs of the career groups and Military Occupational Specialties. The projects on which the students will work throughout this phase will be designed to make optimum use of the facilities at Fort Belvoir, and will tie into mission requirements of local TO&E units such as the 11th Engineer Battalion (Combat), tenant organizations such as the Mobility Research and Development Command, and nearby District and State engineering agencies.

The Engineer version of the Noncommissioned Officer Education System emphasizes the "Whole Man Concept," making provisions for the students' needs in areas exclusive of his military education. An electives program with five major divisions has been devised to that end, offering the student the opportunity, during duty hours, to develop the entire scope of his abilities. The five elective division are as follows:

- High School Equivalency Programs—In coordination with the Fort Belvoir Education Center, this elective provides the individual student with no high school diploma the opportunity to identify and improve upon weak areas in preparation for the General Education Development Test for high school equivalency.
- Preparation for or retake of the Army Classification Battery Test—Individualized instruction is made available to help the student improve scores in the Army Classification Battery Test.
- Northern Virginia Community College—This elec-



tive provides the student the opportunity to pursue an Associate Degree in Applied Technology. Subject matter will include "Human Relations and Leadership," "Basic Psychology," "Effective Communications," "Principles of Data Processing," "American Economics," and "American Constitutional Government," any one of which is available to the student NCO.

- Formal College Credit—For students with a high school diploma or GED equivalency, who desire a baccalaureate degree program, arrangements with local universities through the Education Center have been made.
- Military Electives—USAES is making available to the student, courses in military subjects of special interest.

A requirement has been established for individual student participation in each of two electives, one military and the other the student's choice of the remaining four. To aid the student in the evaluation of his choices, an academic diagnostic test is administered early in the course. This provides in-house and Education Center counselors with substantial input for advising the student on establishing a continuing educational development plan.

Both ENCOES courses, the Basic and Advanced, are currently 12 weeks in length. While the Basic Course is oriented toward providing the E3, E4, and E5 exposure to responsibilities at squad, section and platoon level, the Advanced Course is supervisory or management oriented for the E5, E6, or E7 who will some day be the E8 or E9 sergeant major at the top of the enlisted promotion ladder.

ENCOES is a major departure from the standard, dated approach to enlisted career development. While completion of the basic course is worth 42 promotion points to the NCO, the distinct advantages of having had this newly professionalized course of instruction with emphasis on total career development is worth much more. It is hoped that commanders who will be evaluating their enlisted men for ENCOES will keep this in mind, making the selectees only the best qualified—the doers and movers who always seem to get the job done for the quotas are sure to be small.

Specific information for the prospective ENCOES student or interested reader is available from: Assistant Commandant, US Army Engineer School, Fort Belvoir, Virginia 22060, ATTN: Office of the Secretary.

Major Robert E. Harper is the Chief of the Programs Branch, Curriculum Division, Department of Instruction, The Engineer School, Fort Belvoir, Va. A 1962 graduate of the U. S. Naval Academy, Annapolis, Md., he took his commission in the Army Corps of Engineers. The major subsequently served with the 19th Engineer Battalion (Combat); the 249th Battalion (Construction); advisor to the 51st Battalion (Construction) in Vietnam; and the 2d Engineer Battalion (Combat) in Korea.

DYNAMIC

A New Approach to an Old Problem

Colonel W. R. Hylander

What is this dynamic training program the Army is hearing about?

Is it for real? Can Engineers do it? Can you do it in your unit? If so, when is someone going to tell you how to train dynamically?

I hope to answer these questions on these pages. This article, hopefully, will also give small unit leaders an assist in overcoming some of the problems they have in trying to make day-to-day training realistic, interesting, and effective.

That really is what dynamic training is all about—day-to-day training that is realistic, interesting, and effective. This type of training can be performed in almost any active Army or Reserve component unit. I also has the complete backing of the Army Chief-of-Staff, General William C. Westmoreland.

The Chief-of-Staff set the stage for dynamic trainin in a message to the field in June 1971 which eliminate most mandatory subjects from unit training as well a the requirement for maintaining individual training rec ords at unit level. He directed that commanders at bat talion and company levels have greater flexibility i planning and conducting the training of their units.

Also, to assist small unit training managers in th combat arms, General Westmoreland established Board for Dynamic Training last September at Fo Benning, Ga. This Board was charged with identifyin the problems with training, with assessing their cause and with developing innovative solutions. A representa tive of the Engineer School, Fort Belvoir, Va., was member of this Board for Dynamic Training.

Recognizing an opportunity to improve enginee training, the Commandant of the Engineer School an Commander of the Engineer Center and Fort Belvoi Major General Robert R. Ploger, has initiated a parall effort at Belvoir by establishing an Engineer Dynam Training Council. This Council is continuing indefinite and is designed to provide an enduring link between e gineer trainers afield and the Engineer School.

What, really, is dynamic training? Basically it is not ing new. It is a new name, applied to training that is-

- Tailored to the commander's own appraisal of wh his unit needs.
- Realistically designed to meet those needs, despi

TRAINING

the constraints of reduced strength, limited resources, or scarce resources.

- Imaginative and innovative, from input by the trainers.
- Stimulating, interesting, zestful, and rewarding for the trainees.

Adventure training is one form of dynamic training in which a sport or challenge augments the purely military incentives to learning. For example, orienteering is adventure training.

Dynamic training has been loosely called "shade tree training." It has also been described as "going skiing instead of having physical training (PT). It is these, indeed, but it is more. You can have dynamic training in a classroom, or during a halt on a march, or while performing maintenance on your equipment. Dynamic training is just ordinary training plus one secret ingredient—imagination.

For engineer units, dynamic training can take many forms. Dynamic training could be—

- A domestic action project to build something off-post for a worthwhile cause.
- An on-post construction project assisting the facilities engineer, another unit, or an individual's own unit.
- Integration of a unit's training program with that of a combat arms unit or allied units in overseas areas.
- Competition in military engineering tasks.

The Engineer Dynamic Training Council at Fort Belvoir is trying to come up with some imagination of its own. The Council, which consists of officers from the Staff and Faculty of the Engineer School, has met frequently since October 1971 to review the small unit training problems at Fort Belvoir. They have been studying problems reflected by a survey of certain evaluations involving 400 officers, warrant officers, and noncommissioned officers stationed at Fort Belvoir. The study is patterned after a similar survey that is being conducted by the Board for Dynamic Training at Fort Benning.

Direct contact has been established with the senior engineers of the major commands, the Engineer Training Center at Fort Leonard Wood, the Topographic Command, and some separate engineer units in the continental U. S. A questionaire is being mailed to selected units and individuals to help the Council identify problems and collect innovative solutions. (Responsible persons are urged to respond to this questionaire because it is one of the few ways the Council can communicate with the field.) The Council does hope to have its representatives visit many active Army and Reserve component units in the U. S. and overseas.

The Council is continually looking for imaginative and innovative ideas to help revitalize and stimulate engineer small unit training. These ideas will be published in an Engineer School publication and distributed to the units on a worldwide basis. The best of the dynamic training ideas also will be published in future issues of **the engineer**. Some of the ideas that already have been generated are contained in this feature on "Engineer Dynamic Training."

Just as dynamic training is nothing new, small unit training problems also are nothing new. Here are a few of the old problems with new emphasis.

- The demands for post support—guard, kitchen police, ash and trash, grass cutting—constitute a major problem for all types of units worldwide.
- The lack of materials and sites for river crossings, demolition, and road building are problems peculiar to engineers.
- The boredom that comes with tearing down a bridge you have built, filling in a crater you have blown, or digging up the mines you have laid, constitutes a morale problem.
- The biggest problem, however, is the lack of know-how, motivation, or imagination among small unit leaders. This problem appears to be common all through the Army.

Some solutions that are being considered to alleviate these problems are—

- More emphasis and better instruction in the classrooms at Army service schools on how to plan and conduct small unit training.
- Improvements to the Training Manuals and Field Manuals that discuss small unit training.
- A catalog of "do-it-yourself" training aids, to go along with the catalog of dynamic training ideas.
- Actions to provide engineer materials for consump-

tion in training—timber, cement, and asphalt—similar to training ammunition allowances.

- The Engineer Skills Training program which is designed to upgrade individual construction skills through a combination of correspondence courses and on-the-job training with the facilities engineer.

The Engineer Dynamic Training Council does not have all the answers yet. The Council's program has just begun to get underway but it is already evident—that dynamic training is not widely understood; that there is an underlying reluctance to innovate; and that training often has low priority at small unit level.

It is equally evident, however, that engineer units have been and are doing a lot of dynamic training. Good examples are domestic (civic) action and on-post construction projects. So, too, are cases where engineers train with combat arms units, with allied units, and where they put some competition into otherwise dull training. General Ralph E. Haines, Jr., Commanding General of the Continental Army Command, Fort Monroe, Va., says the engineers have an easier job of making their training dynamic because of their mission than does the infantry, the armor, or the artillery.

There is much more we can do. General Westmoreland has given the small unit leader the freedom and the encouragement to introduce imagination into training. The entire Army is pressing forward to help reduce some of the obstacles to good training. The Engineer School, through the Engineer Dynamic Training Council, is working to provide the know-how for engineer units.

Every engineer can play a part in this program. Think for a moment what should be done to make engineer small unit training more interesting and more rewarding tomorrow, next week, or the next time around. Do it! All it takes is imagination!

Colonel Walter R. Hylander, Jr., Director of Doctrine and Training Development at the Engineer School and Chairman of the Engineer Dynamic Training Council, maintains he has trained dynamically the 1st, 2d, 3, 138th and 288th Engineer Combat Battalions; 487 Aviation Engineer Battalion (USAR), and at the Republic of Vietnam Armed Forces Engineer School. He has a master's degree in Civil Engineering from M.I.T., and is a registered professional engineer in New York and a Fellow, American Society of Civil Engineers.

This article introduces a new department that will officially begin in the next issue of the engieer. In the future, the Dynamic Training Department will be devoted to examples about how units in the field are implementing their methods into the program. There is a catch. It is up to you—the reader—to make this department a success. You may be assured that your training ideas will be published if you send them to us. the editor

MODERNIZING FOR THE FUTURE

William T. Spriegel
Managing Editor

"Okay—we've done our job. We've cleared mines, busted a few obstacles, put in some quickie tactical bridges, roads and airfields. We've paved the way—our troops are settled in. Let's hope that Theater Command can spare some of the construction guys to get some of this workload off our backs and to do some of this fancy work.

"Forget it—no way, man—they're so uptight with what they're doing out where they are that they won't even be thinking in our direction for awhile. They'll probably give out with some more of that good jazz to use what is called "that old engineer ingenuity." Remember that famous saying—flattery will get you anywhere? Well, it sure as the devil won't get this job done to the Old Man's liking. So, let's get with it—we've got one heluva lotta work to do."

If such a conversation appears to be unreal, there is little doubt but that, in the past, similar ones—in language more caustic, bombastic, colorful and profane—have polluted the air surrounding members of non-divisional combat engineer units in the field. History records, too, that they did just what had been suggested—they applied "that old engineer ingenuity" and more than fulfilled their normal combat support mission, making do with what was at hand, and in the process, discovered talents which previous experiences had not revealed.

How do you effect command control over engineer troop units in such situations, and under such conditions?

Some commanders have several proposals which they believe would help.

So—you commanders of non-divisional combat engineer units at all levels—take heed!

As part of a continuing program to improve upon military engineer troop organization, the Corps of Engineers recently completed a special review which took such matters under advisement—and a number of recommendations resulted from it. If reviewing authorities give their blessing to such suggestions, non-divisional combat engineer units may well be in for a bit of face-lifting in the not too distant future.

Lieutenant General Frederick J. Clarke, U. S. Army Chief of Engineers, submitted a report on the results of the review to the Combat Developments Command (CDC) as technical engineering advice for action "as deemed appropriate." (CDC is the Army agency that pulls together ideas on how we should organize and equip Army units and how we should fight and operate, shoot, move and communicate, that is.) Technical information, such as the Corps of Engineers' report, contribute to CDC's determinations.

The report was compiled by a 10-man Special Review Board of officers headed by Brigadier General Richard L. West, who at that time was District Engineer, U. S. Army Engineer District, Albuquerque, New Mexico, and who is now assigned as Comptroller at the Continental Army Command, Fort Monroe, Virginia. The Special Review Board was appointed by General Clarke to examine the structure of current combat engineer units and to determine what changes, if any, in personnel, skills, equipment and employment concepts would provide the best arrangement for combat engineering support to the Army in the field. The Board's report focused on non-divisional types of combat engineer units. A similar review to be conducted by another board will go into the operations of engineer units organic to divisions and separate brigades.

Current arrangements for non-divisional engineer combat support generally follow a pattern which evolved during World War II, and the Army wants to insure that the capabilities of its combat engineer organizations are not outdated, numerically imbalanced, or lacking in quality insofar as the combat support requirements of today and the immediate future are concerned.

In the process of making the review, many Army Senior Commanders were requested to furnish their views on how the organization and doctrine for non-divisional engineer combat support could be improved. A separate questionnaire was sent to senior staff engineers of the Army's major commands worldwide for distribution to field grade and company grade officers asking their opinions on the employment philosophy and organization of the non-divisional engineer combat battalion. These views are reflected in the Board's report.

Non-divisional combat engineer support as of now is provided primarily through the use of engineer combat groups consisting of a group headquarters and a variable number of Army combat engineer battalions and separate equipment companies.

One of the most significant recommendations to come out of the study was for the adoption of a "Universal" headquarters organization for engineer groups and brigades, capable of handling the full range of tactical and technical functions inherent in both combat and construction engineering. There is a big difference in the technical and tactical capabilities of the combat engineer group and brigades. Operational experience in South Vietnam raised some doubt as to the validity of having "pure" combat and construction engineer groups and brigades as envisioned under current concepts of non-divisional engineer support organization, where the former function in the Corps and Army areas of the Combat Zone while the latter would normally operate in rear areas where more complex, heavier and permanent construction is usually needed.

Board recommendations would result in use of "Universal" Engineer Group and Brigade Headquarters for command control of engineer operations at Corps, Army and Theater Command levels, where each would manage the activities of variable numbers of engineer combat or construction battalions in the combination best suited to accomplish the mission as dictated by the situation at hand. Such an arrangement would place no constraint on a commander's decision to shift battalions as he might think necessary.

Under this concept, engineer groups and brigades located in the field army area would be heavily oriented to combat battalions, while those in the rear areas might consist entirely of construction battalions. Depending on the circumstances, the number of combat battalions in the base development area might well be zero, as might the number of construction battalions in the combat zone.

The Board recognized too, that an augmented design and construction supervision capability, as well as increased engineering and design skills would be required by the "Universal" groups and brigades when engaged in a purely base development mission. They consequently proposed the adoption of an "Architect-Engineering" package, consisting of three sections—drafting and design, soils and soils analysis, and the technical specialty of surveying which could be added to group headquarters when needed.

In looking at the nondivisional engineer combat battalion—recognized throughout the Army as the "workhorse" for general engineer support and construction in the combat zone—the Review Board concluded that the present organizational structure was suitable for accomplishing its mission, although they decided that certain changes would make it more efficient and responsive. Its mission traditionally has been to increase the combat effectiveness of Corps and Army troop operations, and to reinforce engineer units of divisions and separate brigades when necessary.

Members of the Board reasoned that by assigning five combat companies to a battalion (rather than four, the present practice), the number of headquarters in a group could be reduced. The number of personnel spaces thus saved could be used to give the remaining battalions the following capabilities—

- Surveying
- Drafting
- Soils testing
- Grading and compaction
- Engineer direct support maintenance

A number of other changes were recommended as a result of the study—

- Increased communications capability, with wider range.
- More automatic weapons.

The Board also felt that non-divisional combat engineers needed a greater capacity for hauling construction materials and the capability to participate in and support airmobile operations. They recommended reorganization of the present light equipment company to include an airmobile equipment platoon and the addition of a platoon of heavy dump trucks (20-tonners) They also proposed the unit be renamed as an Engineer Equipmen Support Company.

One of the potentially more im portant missions of non-divisiona Combat Engineer Battalions is th employment of atomic demolition munitions. However, the Board concluded, after detailed evaluatio that because of the special natur of the mission, unique training involved and the security requirement necessitated by the mission, AD platoons presently attached to suc engineer battalions be placed in

special detachment under control of he engineer brigade. The engineer battalion would retain the responsibility for site preparation and emplacement of the weapon when directed. It was felt that training, command and control, and selection of personnel to be trained could be handled more easily by the larger, more experienced staff at brigade evel. With the advent of air mobility, the Board felt that flexibility for employment would be enhanced by consolidation of the ADM resources.

The study also considered how best to accomplish the peacetime raining for non-divisional engineer units. Many of the combat missions of engineer units are also valuable peacetime tasks. Such horizontal construction and maintenance and epair projects as road constitution, mprovement, repair and maintenance, and bridge building, are deally suited for Engineer Combat Unit training.

Many specific civil engineering tasks may be found on troop installations. These include construction and maintenance of ammunition storage areas, float bridge training areas, airstrips, recreation areas, motor parks, drainage projects, facility demolition, ranges and firebreaks. There are many other projects which engineer troops could complete which would serve to improve the installation far beyond the point possible within the resources normally available—and concurrently serve as a training vehicle for the troops.

Combat engineer units can be a valuable source of assistance for the Facilities Engineer in performing his utilities and building maintenance, and emergency construction functions.

The Board felt that much of this work would add realism and meaning to engineer unit training, and would raise morale while increasing the livability of the installation for all to enjoy.

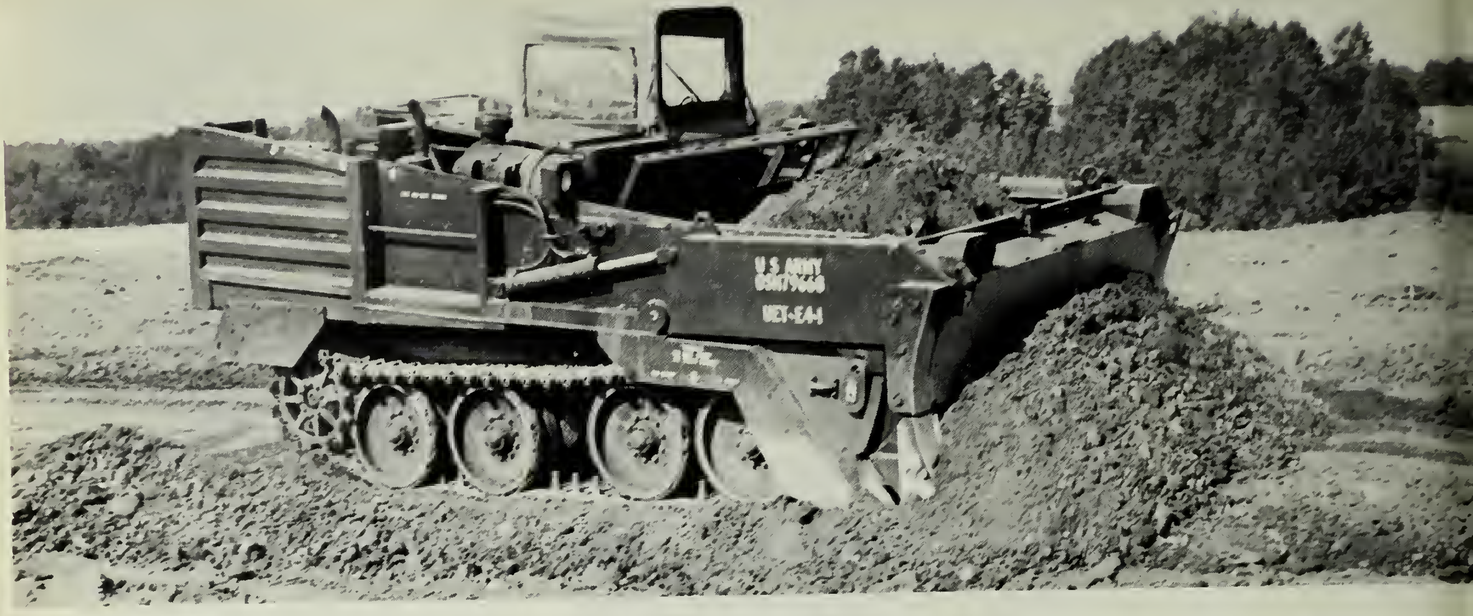
Another aspect of peacetime stationing and training of engineer combat units concerned their availability for use during civil disasters. Because of their command and control structure, their rapid and mobile reaction capability and operational flexibility, the Board considered such units ideally suited for such missions, and recommended that combat engineer units be used in installation facilities projects and disaster recovery operations, which are consistent with the combat missions, functions and capabilities of the units involved.

So—to you members of non-divisional combat engineer units, stand by! Much appears to be in the offing for you. Will it work? To best advantage? Has the Board rightly interpreted the signs, suggestions and Army trends? They were constrained by the need to keep any changes and modifications within the framework of presently available resources (manpower, money and materiel), and to economize where possible.

Let it be said, in any case, that you *are* being looked at—you *are* being thought about—and there *is* concern at higher echelons of command about some of the problems which you have.

"It's ironical," reported one officer—now of field grade rank—who was made action officer on one of the questionnaires sent to the field for reply, and who was present at a recent conference of top-level brass to consider the aforementioned recommendations—"I now can believe what has been said in the past. The Army really does act on recommendations that come from junior officers. It's a good feeling to be able to be in on an official examination at top-level of some suggestions which I, myself, initiated."

Final note—we hope that your recommendations pay off! And that the Army will reap much benefit as a result of your contributions! e



Bulldozing with the UET. In tests at U. S. Army Test and Evaluation Command, the UET has out-dozed the standard medium crawler tractors.

THE UET TODAY

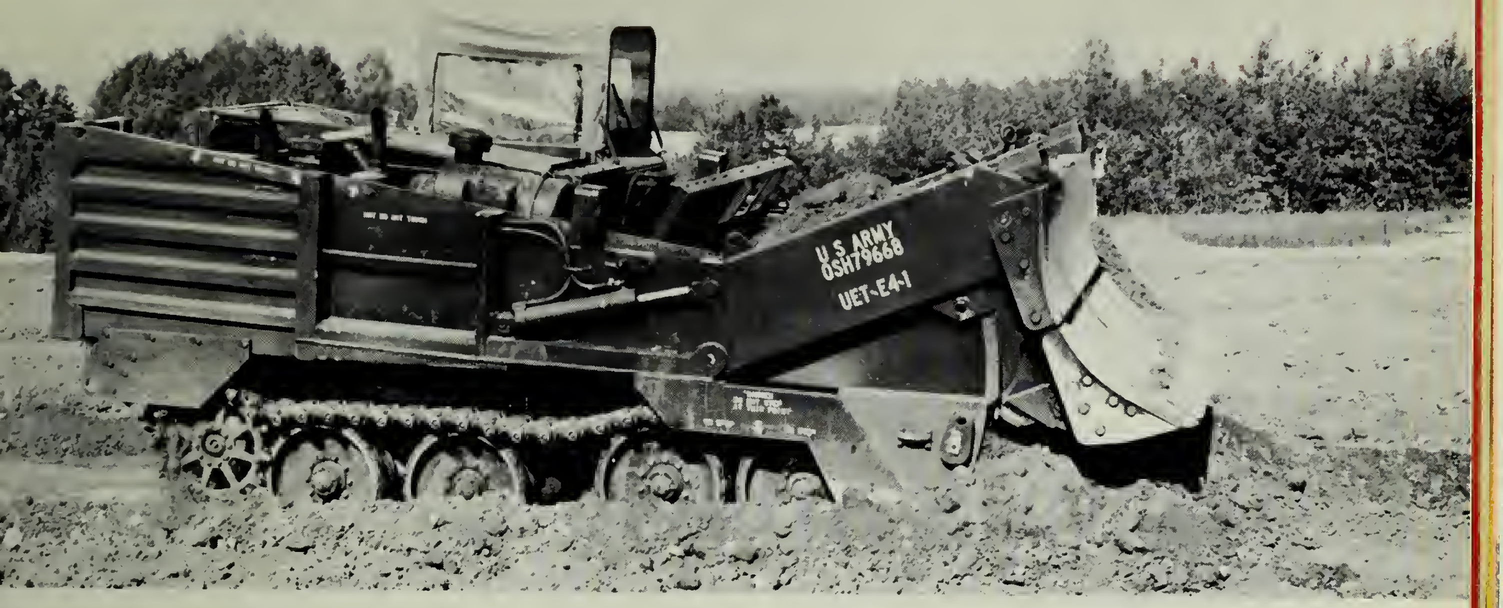
Major Scott S. Collins, Jr.

Having talked to quite a few engineers about the Universal Engineer Tractor (UET), I know that 99 percent of the readers who have read this far, already are having negative reactions regarding the subject. The reaction is automatic. Also from experience, I know that most of the negative reactions are based on erroneous assumptions or outdated information. Therefore the purpose of this article is simply to provide up-to-date information on the progress the Army has made toward getting the UET to the field.

Let us begin by looking at the UET's requirements. The Combat Developments Command (CDC) determined that the users in the field needed an armored, amphibious, multi-purpose combat engineer earthmover. It was to be highly mobile, have high work capacity, be air-transportable, and capable of providing combat engineers with a high speed tractor having mobility equivalent to that of supported units. It also had to be able to bulldoze, scrape, rough-grade, and haul. It was expected to provide the combat engineer unit with a single versatile construction tool that would significantly increase the combat construction potential in a hostile environment.

To meet this requirement, the development of the UET has spanned several years and included more than 11,000 hours of prototype tests. It began in 1956 when the concept was proposed by International Harvester Company as an alternate to a request for wheeled airborne equipment. Four generations have been built and, in the process, the armor and swim requirements have been added. The requirements that the tractor be airdroppable and carry an engineer squad have been dropped.

The UET has been designed to travel light and work heavy in keeping with the mobility requirements. It must add weight for earthmoving operations because performance at a given horsepower is proportional to the gross weight of the vehicle. A rule of thumb fre-



Here the UET is seen loading the eight-cubic-yard scraper bowl. The apron is raised and the road wheels have been raised relative to the hull, exposing the scraper cutting edge to the soil. Once filled the UET is ready for dozing or the soil can be hauled to another site. To empty, the apron is raised and the ejector pushes the soil from the bowl.

quently used for tracked vehicles sets the theoretical maximum draw bar pull equal to 80 to 90 percent of gross weight.

The UET increases its weight for dozing by self-loading its eight cubic yard scraper bowl with about 20,000 pounds of earth ballast and has achieved a draw bar pull of 37,500 pounds with a 32,000 pound net weight vehicle. Another feature that makes the dual role possible is the suspension system. It is a hydropneumatic system—that is hydraulic suspension units backed up by air springs.

For earthmoving, the springs are switched out and the blade height is controlled by varying the flow of oil to the suspension units. For high speed operation, the units operate at fixed pressure and are backed up by the springs. The ride has been rated as better than either the M113 Armored Personnel Carrier (APC) or the five-ton dump truck.

Operating the UET is quite simple. For high speed, the only controls involved are the throttle pedal, brake, steering wheel, and power shift transmission. For earthmoving, the blade height is controlled similarly to the low speed dozers, except that the hull moves with the blade. The operator can see the blade top for the full width and for this reason the UET is somewhat more controllable than the low speed dozers.

Independent tests by the U. S. Army Test and Evaluation Command have verified a top land speed of 30 miles-per-hour and a water speed of three miles-per-hour. The tests also have verified that the UET equals or exceeds the bulldozing capability of the standard medium crawler tractors by moving 188 cubic-yards-an-hour in a 100-foot slot versus 150-170 cubic-yards-an-hour for the standard dozers. It also out-hauls the five ton dump truck over a one mile, secondary-haul road.

The operator of the UET is provided armor which is equivalent to that of the APC. Although performance has been quite good, reliability has not been high enough for issue. Failures have not been concentrated in the suspension system as most experts would assume. The reliability problems have been attributed mostly to random failures throughout the machine, and quality control, rather than basic design errors. All known design problems are believed to have been corrected at this time. Additional data are shown in Figure Two.

Progress is checked during a periodic conference called an In Progress Review (IPR). Members of the IPR include the developer (AMC), the user (CDC), the trainer (CONARC) and the Department of the Army Staff Logistician (DCSLOG). As a result of the IPR held on the UET at the end of the most recent tests, the members have concluded that because the required reliability has not been achieved, additional work will be required before the tractor will go into production.

On advice from industry representatives, the following course of action already has been initiated. Contracts have been awarded to two civilian firms to evaluate the design and make recommendations for improvements. Both firms have had considerable experience in the production of high speed tracked vehicles.

Each firm has been furnished a rebuilt UET prototype, all design data and the test results. After full consideration of their recommendations, it is planned to select one of these contractors to produce the next UET prototypes. Also, an additional full cycle of testing is being scheduled (more than 650 hours of tests for each of the tractors). The UET will be fielded only if all of the requirements are met. The schedule calls for type classification in 1975. The first units would be equipped shortly thereafter. The schedule is tentative and its completion will be based on the successful contractor's appraisal.

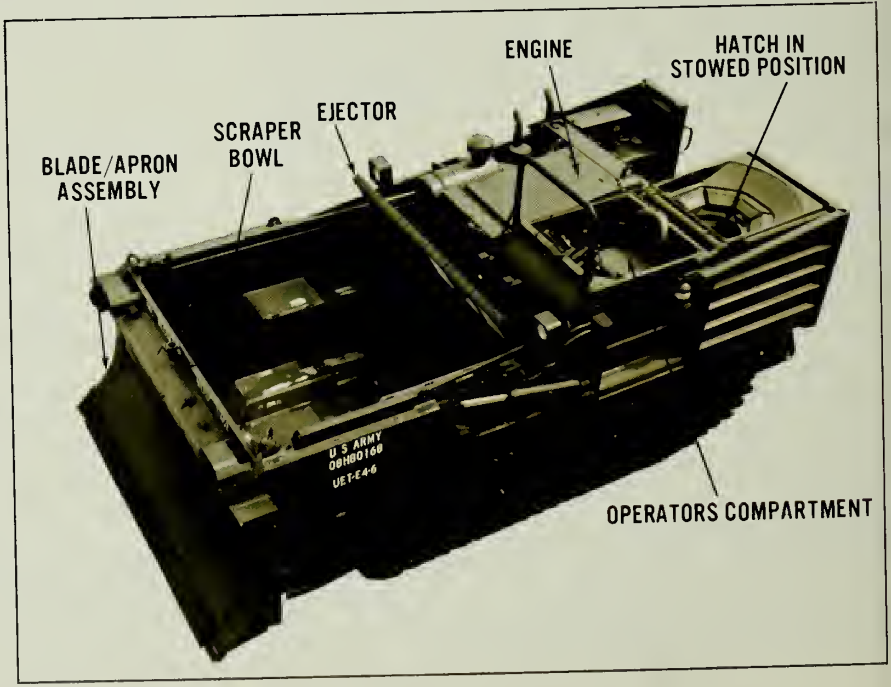
Solving the low reliability problem will be difficult. The required reliability for the UET is comparable to that of commercial construction items—single purpose machines that have no restrictions on weight.

Because of its lightweight requirement, the UET was designed with much smaller safety factors than commercial construction items. High performance at both ends of the speed spectrum has never been accomplished prior to the UET, and complexity has been the price. The UET is more complex than any of the single purpose construction machines. Since reliability is somewhat of a function of the total number of component parts or systems, the added components present another factor that makes the reliability requirement tough to meet.

It is planned to issue the UET primarily to divisional and nondivisional combat engineer battalions. The tractor is expected to replace the medium crawler dozer and some of the low bed trailer, prime movers. The basis of issue is tentative, however, and will be finalized after field evaluation. Issue would generally call for one UET per combat engineer platoon. The planned distribution will result in an increase in capability at a reduced cost.

The UET will provide a versatile, high-speed earthmover to divisional and nondivisional combat engineer units. The tractor will enable the engineers to match the mobility of the units they support. e

Major Scott S. Collins, Jr., the former Special Item Manager of the UET at the U. S. Army Mobility and Equipment Research and Development Center at Fort Belvoir, Va., is enroute to a new assignment in Korea. He holds both a Bachelor of Arts degree and a Master's degree from Michigan Technological University and the University of Michigan, respectively. The major previously served with the 27th Engineer Battalion at Fort Campbell, Ky., and overseas with engineer units in Korea and Vietnam. He is a graduate of the Engineer Officer Advance Course at Fort Belvoir.



This schematic of a rebuilt UET prototype shows changes that may be the answer to the combat engineer's need for a multi-purpose earthmover. Tests to date prove that the UET has armor that is equivalent to the APC and exceeds the bulldozing capability of the standard medium tractors. But its reliability has been low and there will be no UET for the user until all requirements are met.

VALOR AT VICKSBURG

Eugene V. McAndrews

"It is the year of our Lord 1863 and well into the springtime. Your name is Jimmy McClelland, Private, 30th Ohio Infantry, and you wish you were home on your old man's little farm with the cool, rich dirt between your toes and the sunshine warming your back. But you are here in a grimy little Mississippi river town called Vicksburg, playing at a game called war. It will be a long time until you'll see home again, boy, or the farm or your old man. Wars are like that, you know.

"Old General Grant is anxious to take Vicksburg, so the story goes down the line. You've heard that the Army of Tennessee moved 2,000 miles in 18 days, through five successful encounters with the enemy. Six thousand of them Rebels was captured, they say, and 67 artillery pieces. We only lost 4,500. Now Vicksburg. Once you get to moving, you know, it don't do to set and pick at old scars and nits. Johnny's waitin' over there in them woods like always. If we keep on doggin' him maybe he'll just up and quit. I don't want to kill nobody nomore."

The rumors Jimmy heard were true enough. A wily U.S. Grant, using that same "set and pick" logic felt that his momentum would insure a fast victory at Vicksburg by little more than a series of quick assaults. With tragic understatement, however, he conceded that this town was "admirable for defense."

President Lincoln himself supported Grant wholeheartedly, remarking, "We may take all the northern ports of the Confederacy and they can still defy us at Vicksburg. It means hot biscuits and hominy without limit, fresh troops from all the states of the Far South, and a cotton country where they can raise the staple without interference." Lincoln was impressed with Grant's fighting abilities, and with good reason. The cigar-smoking General was bringing home the victories.

Engineers in the Army of Tennessee had offered an unusual idea as an alternative to storming the city—bypassing the city by constructing a canal across the mile-wide DeSoto Peninsula, a landform created by silt deposits at a spectacular, lumbering bend in the Mississippi River. Grant considered the canal plan impractical.

General William T. Sherman, commanding the 15th Army Corps, supported Grant's strategy and readily agreed to order his troops to storm the city. But on the 19th of May, 1863, when the 13th Infantry Regiment led the first charge against the Confederate defenses, withering fire cut it to pieces. The casualty count was disconcerting. Morale sagged and the Army of Tennessee stopped in its tracks.

Confederate General John Pemberton

Union General John G. Parke

Grant suddenly realized that he had underestimated the defenses and the effectiveness of Confederate General John C. Pemberton's engineers. Pemberton's men had constructed a defense line one historian has described as "an achievement of which a military engineer of the 19th Century could be proud."

The defenses were designed by Pemberton's Chief Engineer, Captail Samuel Lockett: His plan created a system of redoubts, redans, lunettes and small fieldworks connected by rifle pits, that would afford the Confederates a continuous line of defense.

In the seven months before the union forces struck, the Confederates had built a nine-mile line to protect Vicksburg from the rear. Nine key forts comprised the strongpoints: Fort Hill, Stockade Redan, Third Louisiana Redan, Great Redoubt, Second Texas Lunette, Railroad Redoubt, Fort Garrott, Salient Works and South Fort.

The strength of the defenses became all too apparent to the engineer officers in Grant's Army, several of whom were line commanders—Colonel Frederick E. Prime, Chief Engineer for the Mississippi campaign; Major General James B. McPherson, in charge of the 17th Corps; Major General John G. Parke, commanding the 9th Corps at Vicksburg; and Major General Cyrus B. Comstock, who had been instrumental in the success of the Mississippi Campaign.

Having witnessed the failure of the attack on May 19, someone proposed another scheme: to bridge the ditch in front of the formidable key, Stockade Redan, allowing the 17th Corps to cross and hit the fortifications with a hammering blow. Though history does not reveal who that someone was, the fact that the decision was a significant one is quite apparent—the "volunteer storming party" (of engineers) created to execute this dangerous task became the most honored contingent of soldiers in American military history.

Union officers agreed that the Stockade Redan had to be taken. Commanding a crucial route into the city, its main earthwork was a redan with an attached stockade. The ground sloped to the front and flanks of the redan, allowing Confederate defenders a fine field of fire. For nearly 200 yards in front of the redan, Graveyard Road ran level in full view of the defenders.

The call went out for volunteers. Because of the lack of engineer troops, Union policy was to create them from the ranks despite their lack of training. Labeled pioneer or pontonier units, they consisted of two percent of the effective force then in the field and were usually commanded by a captain, who was not always an engineer officer.

So the call went out at Vicksburg, with a quota fixed at 50 enlisted men and two officers from each brigade in General Francis Blair's division. When finally assembled, the force totaled 156 officers and men from 15 regiments. They knew well what was expected of them and the price they might have to pay. They were told that if they could bridge the ditch for the 17th Corps, Vicksburg would fall.

With the tools of the engineer—gabions, fascines, ladders, shovels and picks—the party began the attack on the morning of the 22nd May, 1863. Led by Captain Richard H. Wood, 97th Illinois Infantry, and Lieutenant William C. Porter, 55th Illinois Infantry, the group rushed forward toward the ditch, running the 300 yards in three minutes. Confederate fire tore through their ranks. Many fell on the road under their heavy burdens. Pvt. Howell T. Tugwell, 8th Missouri Infantry, carried the colors to the slope of the Confederate escarpment and planted it there. His comrades tumbled into the ditch, which protected them from the fire coming from the redan, but not from sharpshooters farther down the line or from Confederate 12-pound shells that rolled into the ditch.

For hours the assault group suffered under the Confederate pounding. Their attack was stopped. Behind them the advance of the 17th Corps ground to a halt.

The attacks of May 19 and 22 having failed, Grant had his engineers initiate siege operations. Soon Union sapping trenches appeared, angling in a zig-zag manner to the points of the Confederate redans. As the defenders watched Federal trenches inch nearer their positions, they prepared loaded shells with short time-fuses to repel the Northern attackers. On June 25, Grant's engineers exploded their first mine in an effort to tear a hole in Confederate defenses large enough for Union troops to rush through. But the Confederates exploded countermines. After enduring isolation, hunger, constant bombardment and with morale running low, Pemberton finally surrendered Vicksburg. It was July 4, the day after the Battle of Gettysburg. The siege had lasted 47 days.

The fall of Vicksburg cut the South in half. Seizure of the city also reopened the Mississippi, allowing resumption of trade between the Midwest and the outside world. Grant was now free to turn his forces loose for increased offensive operations. The two Union victories signaled the death knell of the Confederacy.

The valiant attempt to bridge the ditch at the Stockade Redan resulted in award of Medals of Honor to 81 men. Their actions were heroic. Grant later wrote in his Memoirs that the attack of May 22 was one he regretted ever having ordered. He was the moving force behind their awards. Captain Wood's citation read: ". . . led the 'volunteer storming party' which made a most gallant assault upon the enemy's works." All the other citations read simply, "Gallantry in the charge of the 'volunteer storming party'."

The Honor Roster included men from the 30th, 37th 47th, 54th and 57th Ohio Infantry; 83rd Indiana Infantry; 6th and 8th Missouri Infantry; 55th, 97th, 113th, 116th and 127th Illinois Infantry; 4th Virginia Infantry; and the 4th West Virginia Infantry.

History, in its timeless, impartial way, has introduced into the story of the siege at Vicksburg an element of controversy about James McClellan, 30th Ohio Infantry, and his 80 gallant comrades. Engineers they were to the satisfaction of the task, but infantry troopers all, they were, on the battle roll. Perhaps the claim is valid with neither the engineers nor the infantry, but, in reality, with that brotherhood of heroes to which all Medal of Honor winners belong.

Eugene V. McAndrews, an authoritative source on the history of the Medal of Honor, is a historian, Office of the Chief of Engineers, US Army, Baltimore, Md. Mr. McAndrews considers his collection of historical material, diaries and memorabilia of US Army winners of the Medal of Honor among the most complete in existence. Credited with a B.A. in history from Carroll College, Helena, Mont., and an M.A. from the University of Oregon, Eugene, Ore., he is presently preparing a Ph.D. dissertation for Kansas State University, Manhattan, Kansas.

Bridging

USMA PREP SCHOOL PREPARES MANY MEN FOR WEST POINT

MANY ENLISTED MEN do not know that the Army conducts a school which is designed to help them successfully compete for appointment to the United States Military Academy at West Point, N. Y. All inductees, Regular Army, Reserve and National Guard enlisted men on active duty may apply for admission directly to the U. S. Military Academy Preparatory School at Fort Belvoir, Va. The Prep School has an annual 10-month program (August through May) that prepares and trains selected individuals to successfully compete for appointment to West Point. For further information, applicants on active duty should write: Commandant, USMA Preparatory School, Fort Belvoir, Virginia 22060. Civilians, Army Reservists, and National Guardsmen not on active duty may apply to The Adjutant General, Department of the Army, Washington, D. C. 20314, ATTEN: AGPB-M (Mr. Patton). Selected civilians will be issued instructions for joining the Army. Active duty applicants should submit their applications according to June 1 of the year entry to USMAPS is desired.

IT TAKES MONTHS TO PROCESS APPLICATIONS FOR OVERSEAS TOURS

SOLDIERS DESIRING OVERSEAS tours must start the paper work themselves by submitting applications at their unit personnel offices. From there, applications are forwarded for recommendations at each command level. Requests for Vietnam duty must be forwarded to the Department of the Army regardless of approval or disapproval within the chain of command. For any other area, the request may be disapproved by the major headquarters. Disapproved applications are returned to the individals concerned. About a month after an application is submitted, DA receives it and sends a card with personnel data on the applicant through an initial processing machine. Then the request for overseas duty is matched against current requirements. If no requirement exists for that grade and MOS, the applicant is so advised. If such a position is available, the matched assignment information and requirement cards are processed in the next bi-monthly machine assignments. A roster of assignment instructions then goes out to each major losing command where new assignment instructions are forwarded to the losing installations. It usually takes about 60 days to process an overseas application—from the day the paper work was first submitted to the day when the new assignment orders are issued.

ARMY WANTS QUALIFIED JUNIOR OFFICERS TO APPLY FOR RA APPOINTMENT

THE ARMY STILL has a retention requirement for highly-motivated, well-qualified junior officers, even though recent strength reductions have made attaining career status more competitive. Commanders and supervisors should continue to encourage best-qualified junior officers to maintain Voluntary Indefinite (VI) status or to apply for Regular Army appointment. Officers not now in career status who want to remain in the Army past their release dates should contact the Engineer Branch immediately for advise on how to proceed.

the Gap

EM ARE URGED TO KEEP AOR CARDS CURRENT

ENLISTED PERSONNEL through grade E6 returning from an overseas tour should take advantage of the Advanced Overseas Returnee (AOR) card. Approximately six months prior to an individual's date of expected return from overseas (DEROS), he should contact his unit personnel officer to correct information that is outdated or in error. The AOR card is punched with information provided by the losing command that will help the Department of the Army issue assignment instructions. The Army has this information on each individual in the AOR card—name, social security account number, rank, PMOS, number of dependents, estimated termination of service (ETA) date, and the area that was indicated as the preference for his next assignment. The area of preference for AOR purposes must be current if an individual is to receive the new duty station he wants.

OPO MOVES TO AUTOMATE PERSONNEL RECORDS

THE CURRENT PROGRAMS to more fully automate personnel records should reach fruition by the end of 1972. The Department of the Army Form 66 will be replaced by the computer-generated "Officer Record Brief." The Manual Report of Change, DA Form 2876, will be replaced by Mark Sense forms if tests now underway prove successful. This means that all officers should pay particular attention to the accuracy of their own personnel records during the coming months. Engineer Branch has the capability of correcting the Officer Master Tape Record through its new ADP equipment. Officers discovering errors in their records should have their personnel officers notify the Engineer Branch without delay so the Master Tape Record may be corrected.

ADPRID OFFERS DUAL PROGRAM FOR APPLICANTS

THE ENGINEER BRANCH has announced that openings are available for officers desiring to obtain a master's degree preceding assignment to the same school as an ROTC instructor. Applications for the Advanced Degree Program for ROTC Instructor Duty (ADPRID) may be submitted at any time in accordance with Department of the Army Circular 621-7. ROTC positions are open for 1972 through 1974, especially in the Midwest.

WANTED! COMMISSIONED OFFICERS TO TRAIN AS ROTARY WING AVIATORS

A DECREASE IN WARRANT officer candidate flight training has created a need for commissioned officers to be trained as rotary wing aviators. To be eligible, officers must have less than 48 months commissioned service at time of entry and should have an above average performance record. Interested officers should consult AR 611-110 for information or contact the Engineer Branch.

ENGINEER SCHOOL ESTABLISHES NEW ACADEMIC DEPARTMENTS

ENGINEER STAFF

Three new academic departments have been established at the Engineer School, partially as a result of the introduction of the two Engineer NCO courses.

The Department of Engineering and Military Science (D/E&MS) has been divided into the Department of Military Science, the Department of Engineering Science and the Department of Applied Engineering.

The primary reason for the reorganization was that D/E&MS had become too large to operate efficiently with the addition of the new courses. Also, the change was made in an effort to establish a closer director-instructor-student relationship, which is expected to provide a more efficient teaching program and better learning on the part of the student.

An organizational study group considered 16 alternatives for the reorganization before recommending that the three new departments be organized. The plan was approved and put into operation last August.

Under the reorganization two divisions of D/E&MS, Combined Arms and General Support became the Department of Military Science and assumed responsibility for the NCO courses. The subjects of instruction include combined arms organization, nuclear weapons and weapons systems, chemical weapons, international relations, leadership, command and staff functions and procedures, enlisted personnel management, staff writing, military justice, drill and ceremonies, and Civil Affairs and Army Aviation.

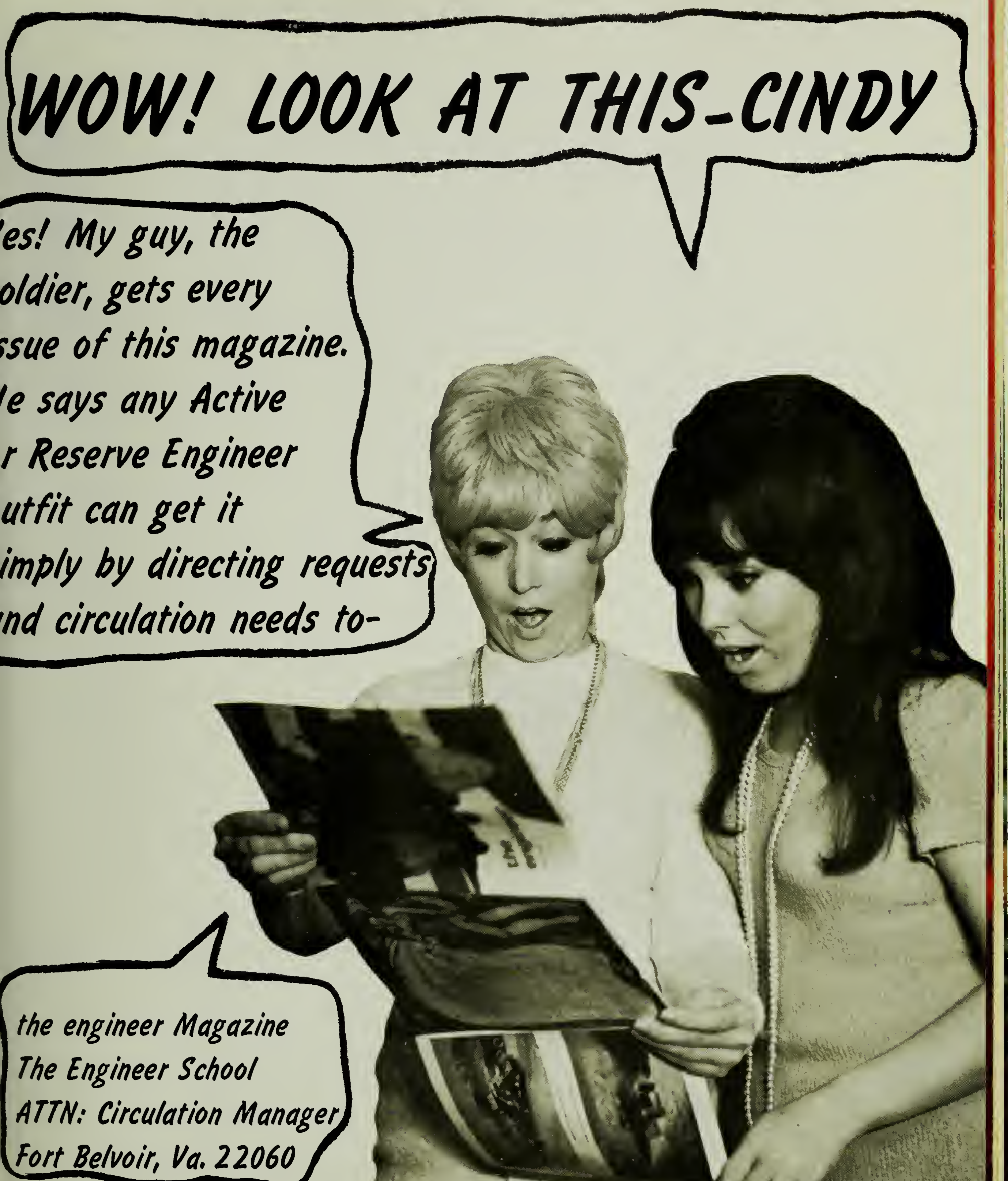
Combat Service Support subjects being taught include Army Supply procedures and functions, Ordnance, Transportation, Quartermaster, Adjutant General, and Medical Service Support functions.

The Combat Engineering Division became the Department of Applied Engineering and is teaching the Engineer Officer Basic Course. Subjects covered in the course include bridging, field engineering, Atomic Demolition Munitions (ADM), demolitions and mine warfare.

The Construction Engineering Division became the Department of Engineering Science and is responsible for the Engineer Officer Advanced Course. The department teaches professional engineering subjects including construction, military engineering, functions of the Corps of Engineers, operations research/systems analysis, automatic data processing systems, geology, Army Command Management, environmental sciences and pollution control.

Activities of the Nuclear, Biological and Chemical Division were distributed among all three of the new departments. No changes were made in the other two departments of the School: the Department of Mechanical and Technical Equipment and the Department of Topography.

One of the projected improvements as a result of the reorganization is that the new departments will be more responsive in implementing changes, particularly in curriculum. With smaller organizations and closer relationships between staff, faculty and students, changes in what and how to teach can be made easier and more effectively.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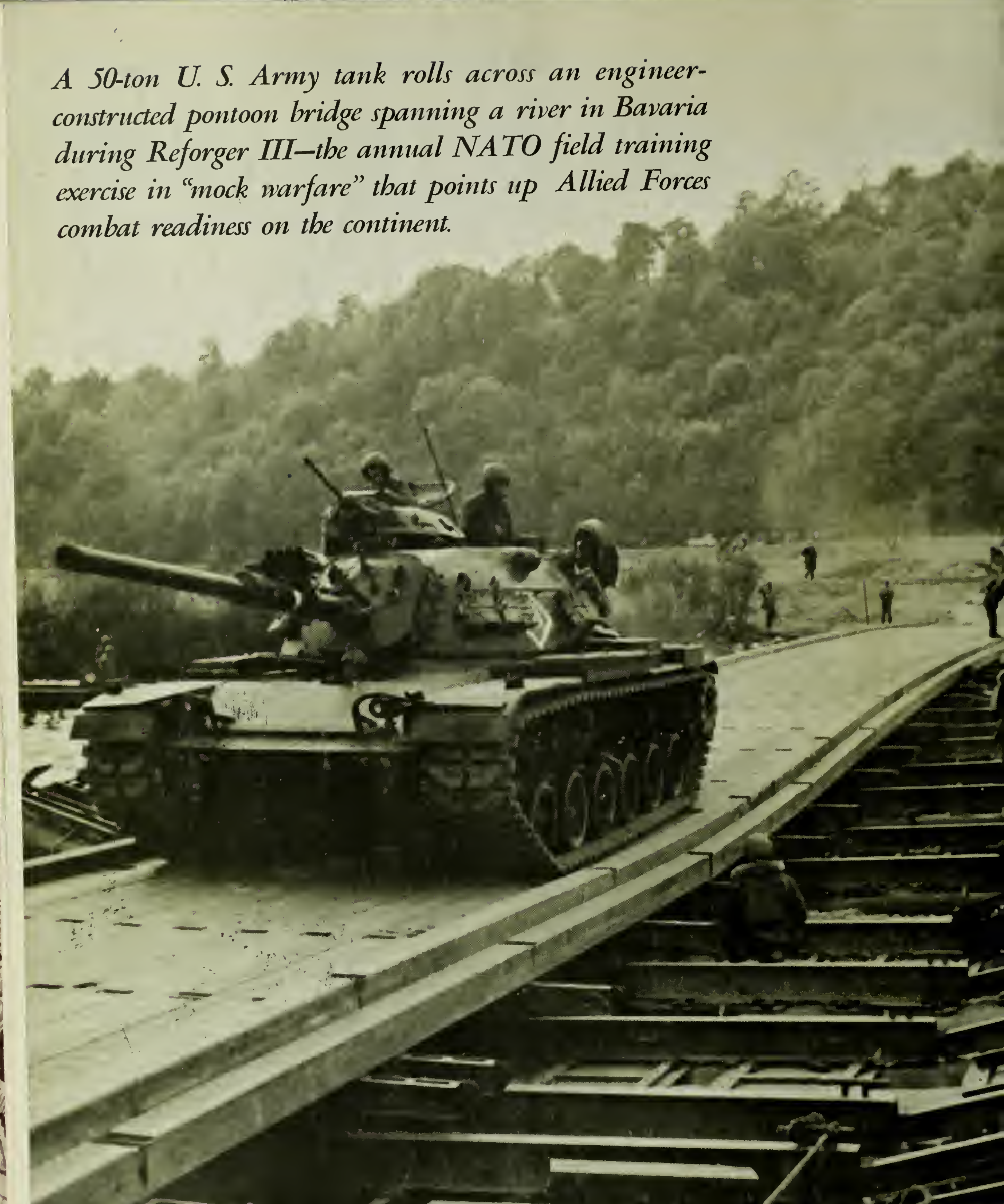
A 50-ton U. S. Army tank rolls across an engineer-constructed pontoon bridge spanning a river in Bavaria during Reforger III—the annual NATO field training exercise in "mock warfare" that points up Allied Forces combat readiness on the continent.



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CHIEF'S BRIEFS.....

Little is known of the private life of America's third Chief Engineer, Major General Louis Le Beque de Presle DuPortail, except that this distinguished French officer was born in 1743 in Pithiviers en Gatinois, a small town in the neighborhood of Orleans and was educated at the military school of Mezieres, where he qualified as an officer of Engineers at the age of 18.

During the summer of 1776, the Minister of War directed him to prepare a new set of rules for the French Engineer Corps. As a reward for his work and his eager response to the Minister's suggestion that he go to America to fulfill a special request made by the American Congress for four outstanding foreign engineers, DuPortail was admitted to the Royal Corps of French Engineers with the rank of lieutenant colonel and subsequently joined General George Washington's Army. He was promoted to colonel and named Chief of Engineers in the Continental Army by resolution of the American Congress in July 1777.

As Chief Engineer and later as the first Commandant of the "Corps of Engineers" (which the Congress formally established in 1779), he became one of General Washington's most trusted advisors and was responsible for planning and directing the defenses which kept the Army safe during the darkest period of its history—the terrible winter of 1778 at Valley Forge.

DuPortail attained the rank of major general in the Continental Army after his brilliant work in directing the Siege of Yorktown where success in October 1781 meant final victory for the American cause. Before retiring and returning to France in October 1783, he was directed by General Washington to develop plans for a new American Engineer Department. These plans later laid the groundwork for establishment of the present Corps of Engineers and the United States Military Academy at West Point. As a result, the general has often been referred to as the "Father" of the Corps of Engineers.

DuPortail bought a small farm near Valley Forge, the scene of his best-remembered activities in this country. He remained there until 1802 when he decided to return to France. But the general never reached his destination alive. He embarked in Philadelphia, but died on the passage over to his native land. ⊖

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Fort Belvoir, Virginia

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1LT Allen Sevier

Art Director
John W. Savage, Jr.

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ABOUT THE COVER

Art Director John W. Savage, Jr., envisions the role of the Engineer instructor at Fort Leonard Wood, Missouri, as he takes a raw trainee and molds him into a proud member of the Modern Volunteer Army. He sees a parallel between the instructor and a sculptor who takes a raw piece of material and refines it into a piece of art.

Pipeline

FIBROUS CONCRETE STRENGTHENS AIRFIELD RUNWAY PAVEMENTS

Recent comparative testing of plain and fibrous reinforced concrete has yielded unprecedented results that may well provide an economical means of upgrading every military and civilian airport in the United States.

Composed of cement, fine and medium-grade aggregate, and steel fibers one-inch-long and 16 mils in diameter, fibrous concrete reveals remarkable durability and strength. Tests show that the material has a capacity to reinforce in all directions and at all locations. Fibrous concrete retards deterioration, extends pavement life and should require less maintenance than conventional concrete pavements.

Tests were performed by the U. S. Army Construction Engineering Laboratory (CERL) of Champaign, Illinois, in conjunction with studies being conducted at the U. S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

During the testing, both fibrous-reinforced and plain concrete pavements were subjected to simulated loadings of the C5A military cargo plane. The fibrous pavement was only half as thick as the regular pavement, but it withstood twice as many load applications and incurred far less damage. When the regular pavement was virtually destroyed, the fibrous pavement still had useful life.

After 700 loadings the plain concrete pavement was reduced to a shattered condition, while very few hairline cracks appeared in the fibrous concrete after 1,400 loadings.

SKYCRANE USED TO EXECUTE UNIQUE FEAT

Can you thread two needles with two threads at the same time? Moreover, would you risk hoisting a 19,750 pound load with a 20,000-pound maximum lifting capacity?

Well, Company "C," 97th Engineer Battalion (Construction), Fort Riley, Kansas, combined with the 263nd Aviation Company, Kansas National Guard from Topeka, to perform this difficult feat.

It was a "first" for both outfits and was accomplished during the tower construction of a water training facility at Fort Riley's Break Neck Lake.

Members of the 97th constructed the tower which was simple enough —two gigantic 90-foot utility poles with bracings, a ladder, and a personnel launching platform.

The real problem was how to get it placed and secured in a vertical position. This is where the 263rd came into the act. Slings were attached to the top of the tower and to a CH-54 Skycrane (see photo).

Then, using 98 percent of its lifting capacity, the big "chopper" raised the tower into the air to a vertical position and moved it to a prepared site.

Here, there was a bit of maneuvering as the 22-inch-in-diameter base ends of the tower poles were jockeyed into two 24-inch-in-diameter holes 15 feet deep and 12 feet apart.

The 97th, however, knew the job could be done. After all, their motto is "No Task Too Great."

ARMY ADOPTS NEW CABLE SET FOR FIXED BRIDGES

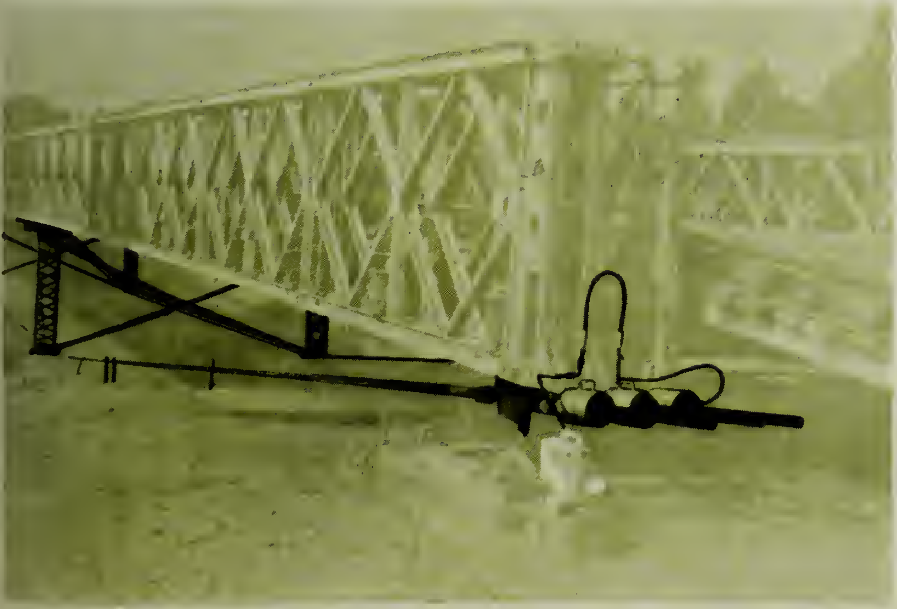
The Army has adopted a Cable Reinforcement Set for the Bailey-type M2 panel bridge that will substantially reduce construction time as well as the number of personnel that are required to erect the military standard fixed bridge.

Developed by the Marine and Bridge Division of the U. S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Virginia, the set has been typed Classified Standard A. This means the set is the most advanced and satisfactory item available to satisfy current requirements.

The set employs cables supported below the bridge trusses to apply a "pre-stress" condition. These cables are connected to the end posts of the trusses by means of a special beam. They are tensioned by hydraulic cylinders that are capable of stressing three cables simultaneously.

As a result, this reinforcement gives a triple-truss, single-story panel bridge the same 60-ton load-carrying capacity for 170-foot spans as the triple-truss, triple-story.

The reinforced single story bridge requires 192 fewer panels with fittings and consequently, bridge construction time is reduced from 20 to 8 hours. The bridge crew is reduced from 155 to 63 men and the manhours, from 2,945 to 504.



USAREUR ENGINEERS CITED FOR 'REHAB' WORK IN GERMANY

The Facilities Engineering Division of U.S. Army, Europe, has been awarded the Presidential Management Improvement Award for its efforts to improve accommodations throughout USAREUR (see **the engineer,** Winter Issue, "Westward Ho!").

The award—signed by President Richard M. Nixon—was based on the division's rehabilitation work on troop barracks in Germany. The program involved work on 120 Army kaserns (posts)—26 of which have been completely renovated or are nearing completion). Other work for which the division has been cited includes heating plant improvement, fire prevention, providing prefabs for isolated sites, reduction of the backlog of essential maintenance and repair from $150-million to less than $100-million, and decentralization of power procurement.

ENGINEERS NAME ITSCHNER WINNER

Company A, 326th Engineer Battalion (Combat), 101st Airborne Div. (Airmobile), will receive the Itschner Award, as the outstanding Army Engineer unit of 1971.

Co. A, which recently returned from the Republic of Vietnam to Ft. Campbell, Ky., was cited for support of Operation Dewey Canyon II, LAMSON 719.

engineer interview:

with command sergeant major Robert W. Elkey

Reaction among professional soldiers to implementation of the Modern Volunteer Army program has been animated, to say the least. The resultant polarization of opposing factions has pitted the more progressive younger soldier who more accurately reflects attitudes within the civilian community, against that hard core of older careerists whose attitudes reflect a life style committed to a highly specialized extension of that same civilian community.

It was with this controversy in mind that the staff of **the engineer** *visited the U. S. Army Training Center and Fort Leonard Wood, Missouri, to get a grass roots impression of "what's happening" to the engineer soldier in training. Based on what* **the engineer** *discovered at Leonard Wood, a series of relevant questions was proposed to, and subsequently entertained by Command Sergeant Major Robert W. Elkey, CSM of the U. S. Army Engineer Center and Fort Belvoir, whose most recent Permanent Change of Station was from assignment as Command Sergeant Major, 1st Engineer Advanced Individual Training (AIT) Brigade, Fort Leonard Wood, Missouri.*

A veteran of 24 years' service, CSM Elkey originally enlisted in the U. S. Marine Corps during WW II and served as a Marine until 1946 when he became a member of the U. S. Army Reserve. With the mobilization of U. S. Army forces for the United Nations commitment to the Korean Conflict, he again volunteered for active duty. He was assigned briefly to Fort Devens, Massachusetts, and then to Germany, where he served as platoon sergeant and intelligence sergeant of various engineer units until his return to the United States and Fort Lewis, Washington, in 1955. In succeeding years, CSM Elkey returned to Germany as Chief Engineer NCO for VII Corps, and subseqently was reassigned to the Continental United States (CONUS) as Sergeant Major and Senior Instructor of the ROTC Detachment at the South Dakota School of Mines and Technology, Rapid City, S. D.

More recent assignments have included tours in Vietnam in 1966 and in 1969, during which he served as Command Sergeant Major of the 937th Engineer Group (C). Bracketing his tours in Vietnam were assignments in CONUS both times as Command Sergeant Major of the 1st Engineer Advanced Individual Training Brigade at Fort Leonard Wood, Missouri.

Selected as Command Sergeant Major for the U. S. Army Engineer Center and Fort Belvoir, he was reassigned from Fort Leonard Wood to "The Home of the Engineers" at Fort Belvoir, Virginia, in August of 1971. Accompanying him on this tour of duty are his wife and one of his four sons—another son is also in the Army, stationed at Fort Dix, New Jersey.

ENGR: SGM Elkey, while you were Command Sergeant Major of the 1st Engineer Advanced

"I'm an old 'brownshoe' man myself."

"What we want and need most is the professional . . ."

". . . doing your own thing—i
what is important."

Individual Training Brigade, Army Chief of Staff William C. Westmoreland outlined guidance for the Modern Volunteer Army concept, citing enhancement of service attractiveness and removal of irritants to the troops. In general terms, what was the impact of implementing MVA at the training brigade level?

CSM: Well, as far as actually implementing it, there was no problem because the Chief of Staff said it was going to be done, so we did it. Our principal problem at the Fort Leonard Wood area I was in was the power load, quite frankly. We were in WW II mobilization-type barracks with the old wiring which had not been increased to handle for example, beer in the mess hall where you had to have additional coolers. The existing wiring would not take the power load so we had to improvise to get beer to the trainees in the mess hall. It meant that somebody simply had to use his imagination. The no sign-in, sign-out provision was no problem, as to its implementation, but we did run into a problem because some of the younger troopers took advantage of the fact that they didn't have to sign in and out on weekends. They would take off and just disappear. We even had one man who flew all the way to Alaska one weekend and got snowed in and couldn't get back.

ENGR: Was there a noticeable increase in the Absent Without Official Leave (AWOL) rate?

CSM: Yes, the AWOL rate did go up at first, but then leveled out.

ENGR: Did initial MVA changes, such as elimination of many seemingly unreasonable troop formations and implementation of a shorter work week enhance or hinder accomplishment of the training mission of your cadre?

CSM: In the long run, I believe it enhanced the training because we were able to eliminate some of the unnecessary training which had been going on (outdated training such as corduroy roads, chespaling, etc.) and concentrate on types of training which have practical application in Southeast Asia or a more conventional theater of operations.

ENGR: How did your cadre react to MVA changes that liberalized such traditional policies as daily reveille formations and the "white sidewall" haircut?

CSM: Well, as to be expected, there was some resentment of it at first, but the truly professional NCO recognized these things for what they were—particularly the reveille formation which had outlived its usefulness many years ago. Quite frankly, in my own company when I was first sergeant, I never had reveille formation except once a month. There was a work call, of course, but that is quite necessary—especially with the trainee—to keep abreast of the whereabouts of the troops. In fact, it is an effective training vehicle to teach trainees good habits like eating a solid breakfast to start the long 8-, 10- or 12-hour training day the right way. So far as haircut policy is concerned, the change hasn't bothered me or the bulk of my cadre. Grooming, within the guidelines of the regulation, is what I'm concerned about. After all, longer hair isn't going to impair the man's ability to get the job done.

ENGR: How do you characterize the trainee going through AIT at Fort Leonard Wood today? Does his circumstances as "better educated and better informed" than his (post-WW II and Korean War) predecessors make him more difficult to motivate and train?

CSM: Motivation is the job of every NCO, regardless of his assignment—whether it be a TO&E or a training outfit. The properly motivated, professional NCO cadreman in a training brigade such as the 1st AIT Brigade at Fort Leonard Wood can effectively motivate his people because he can and does make them realize the reasons for the type of training they are getting. Today's highly-educated trainee, in fact, seems more easily motivated and "trainable" than his predecessors. Educational level then, it seems, is a significant factor in determining the relative trainability of the new soldier. Recently, through chance, two sister companies in the 1st AIT Brigade at Leonard Wood were filled

"...our basic training tools- cadre and instructors-have had to burn the midnight oil to augment practical experience with the rudiments of theory."

in a distinctly contrasting manner. One became a company of enlistees and draftees with an educational level of 9-plus years, while the other became a unit composed of enlisted Reserve and National Guard trainees whose educational level was 13-plus years. With virtually identical cadre and the same combat engineer type of training, the latter company excelled and was cited by the commanding general, while the former did poorly overall.

ENGR: Do you think then, that the more sophisticated, worldly trainee is easier to work with?

CSM: In the respect that he is easier to reach—yes. But in that same sense, our basic training tools—cadre and instructors—have had to burn the midnight oil to augment practical experience with the rudiments of theory. As a conseqence, the cadreman oftentimes has to "push himself" to keep up with the trainee! He has had to work at expanding his educational horizons to keep his job.

ENGR: Do you think the new Non-Commissioned Officer Educational System is a sound idea that will program the professional NCO with the education he needs to accommodate today's trainee?

CSM: Definitely. This new approach to career development for NCOs has been needed for a long time. It offers a more effective in-service education for the career NCO and, in addition, provides the impetus for pursuing the very essential civilian education upon which he must base much of his professional expertise. I firmly believe that civilian education is an essential facet of professional development and advancement. In fact, I would predict that someday soon two years of college credit will be a prerequisite for promotion to E-8 or E-9.

ENGR: The MVA program, so its spokesmen say, is designed to "strengthen the Army as an institution." Of the three major categories into which MVA energies are being channeled to that end, the effort to strengthen professionalism seems to be the most critical as it involves building legitimate, positive incentives to attract and retain high-quality people. What positive incentives have been developed to that end since the advent of MVA?

CSM: Again, in the enlisted area NCOES is perhaps the most significant step, providing enlisted career development with a much-needed shot in the arm. The engineer version back here at Fort Belvoir is quite outstanding because of facilities—the Education Center and the U. S. Army Engineer School—and expertise that has been tailored to the needs of commissioned officer career development. The enlisted variation has been patterned along those lines and is easily adapted to this training environment.

ENGR: Do you feel that recent increases in pay have done something to help attract the potential careerist into the ranks, perhaps in the sense that the civilian/service salary differential is shrinking?

CSM: Quite frankly—yes. But I don't think increased pay is the only answer to attracting professionals. Factors such as patriotism and sense of duty to country are significant. Personally, I've been around the Army for quite a few years, and pay has been secondary beyond what I felt was necessary to take proper care of my family. I just haven't worried about it. I feel that the important thing is job satisfaction and doing with my life what I care about. I'm career military and consider myself as much a professional as a doctor or lawyer or businessman on the outside. That factor—doing your own thing—is what's important. If the Army is your thing, you'll buy it without thinking twice about the pay.

ENGR: Do you think, that once the stigma associated with our involvement in Southeast Asia is a thing of the past, the Army will find itself in a better position to negotiate for talent on the job market?

CSM: I think so. This Vietnam thing—as no other in our history—has been unpopular. Recruitment, the accessions system, has been a serious problem area after every major war in which we've been involved—with reductions in strength requirements within the system and the foul taste of death in the mouth of the public. But, in the sense that history repeats itself, the plateau at which we arrive after the dust settles will afford us the opportunity to rebuild our professional force as we did after WW II and the Korean Conflict.

ENGR: The Army Chief of Staff has directed "commanders at every level to take rapid and positive actions which enhance service attractiveness and remove irritants to the troops." Of those actions implemented—not only at Fort Leonard Wood, but also Army-wide—which do you think are the most significant?

CSM: Those initial actions which had the most impact on the troops were elimination of pass distance restrictions and sign-in/sign-out requirements—and they make sense for the most part. If a man has the money and desire to take a trip and feels confident that he has enough time to get there and back without absenting himself from his job, there's just no sound reason to hold him back. If he blows it, it is his own personal problem for which he will have to take his lumps . . . So far as elimination of a sign-in/sign-out requirement is concerned, I feel that it is a fine idea intended to eliminate an institution used by some unscrupulous officers and NCOs as troop harassment. Unfortunately, it also impairs the company-level administrator's ability to keep track of people for the eventuality of emergencies such as death in the family or the like.

ENGR: The 4th Engineer Advanced Individual Training Brigade at Fort Leonard Wood was recently moved into new brick barracks which represent a fantastic improvement over the old frame "mobilization" type of two-story barracks which still house your old unit, the 1st AIT Brigade. It would be logical to assume that this represents a positive step toward making Army life more tolerable and training easier to accomplish because of the effect such a move would have on morale. Is this really the case?

CSM: Oh, yes. Definitely. The old type of barracks is outmoded and sometimes just plain worn out. In the winter, the wind seems to blow right through them and the old oil heating plants just don't do the job. Wiring is inadequate to accommodate today's trainee who has, in many cases, his own radio or phonograph or even television in a partitioned billet. The move to new brick barracks was a real godsend for the 4th Brigade in the sense that it helps provide the basic human needs of the trainee—with a little bit of icing on the cake to boot. We wish we in the 1st Brigade had been the ones to move. But there was a morale equalizer in the 1st Brigade—company mess halls that could cater more easily to the individual soldier than the battalion mess into which the 4th moved.

ENGR: A recent revamping of pay for lower grade enlisted men has made the dollar differential between pay grade E-2 and E-5 far less dramatic than ever before. That fact, along with recently extended time-in-grade requirements for promotion to E-5, has made advancement at that level far less important to the non-careerist. How has this circumstance affected the attitudes of the Vietnam returnee or lower-grade enlisted man close to Estimated Termination of Services and return to civilian life?

CSM: Although in the material sense, the rewards of advancement at that level are less significant than before, I think the average soldier in that situation will do a decent job anyhow. For the man who is really short, however, I don't think there is or ever was an effective way to motivate him to do a good job. In fact, if a man is due to return to the states for less than a year from a

> **. . . in the sense that history repeats itself, the plateau at which we arrive after the dust settles will afford us the opportunity to rebuild our professional force as we did after WW II and the Korean Conflict."**

short tour and has decided to get out, he should be separated at that point rather than reassigned as a short-timer. He wants out now and is a potential headache over an "obligation" status in or out of his Military Occupational Specialty.

ENGR: In that vein, redeployment and deactivation of engineer units formerly committed to Southeast Asia have sent back here to stateside posts a large number of the "instant" variety of sergeants E-5 and E-6 who don't have a great deal of experience under their belts. On the whole, how have these individuals adapted to troop duty and administrative drill to which they were not normally exposed in a combat zone?

CSM: The majority of them are doing an outstanding job. In fact, I'm quite proud of the personal association I have had with many of them. However, there is that element of incompetence that crops up occasionally in any grouping of personnel with which one has to cope. I do think that leadership schools back here in the states are essential for people in this category and can provide a base of training to compensate for that lack of experience characteristic of the "instant" NCO.

"With the advent of the Noncommissioned Officer Education System patterned after the commissioned officer training scheme and somewhat standardized within a branch or Military Occupational Specialty, quality is guaranteed."

ENGR: Fort Leonard Wood is the home of the Engineer Noncommissioned Officer Candidate Course which, because of implementation of the Engineer Noncommissioned Officer Education System here at Fort Belvoir, is being phased out. How much of an improvement does ENCOES represent over "local" and specialized "spit-and-polish" varieties? Do you think this approach to enlisted career development will adequately meet the needs of a "new action Army" in which complexity of equipment and sophistication of leadership problems is increasing?

CSM: Well, the Engineer Noncommissioned Officer Candidate Course at Leonard Wood was activated, along with the Skill Development Base, to meet the needs of the Vietnam buildup. We just had to emphasize quantity rather than quality. So far as the "spit and polish" local NCO academies are concerned, they did serve a useful purpose in building esprit and steeping the candidate in tradition and ceremony as a matter of course. But the training varied so greatly from school to school and with significant turnover in cadre that there was no assurance in fact, that a man had attended, an NCO course, who had been properly trained. With the advent of the Noncommissioned Officer Education System, patterned after the commissioned officer training scheme and somewhat standardized within a branch or military occupational Specialty scheme quality is guaranteed. Yes—it is a great improvement over the old approach and quite logically will meet the needs of a Modern Volunteer Army in providing a highly competent enlisted leader.

ENGR: Both of the Engineer Advanced Individual Training Brigades at Fort Leonard Wood are engaged in training that they refer to as "maximum hands-on." What is the "hands-on" approach and how effective is it compared to the training theme it has replaced?

CSM: "Hands-on" training is simply instruction that emphasizes student participation and practical exercise. Classroom instruction, of course, is utilized to orient the trainee but is far less a part of the total block of instruction than it used to be. The "hands-on" approach makes good sense in engineer training. One just can't appreciate the difficulties in, for example, erecting a Bailey bridge until one tries to do something as simple as lift a panel and pin it into place. The right and wrong of it will fall right into place when the bridge is launched across the gap—or perhaps the next morning when a sore back graphically illustrates the use of an improper lifting technique. In a nutshell, I'd say it is a great approach to training. We can't, in my mind, get enough of it.

ENGR: Fort Leonard Wood, quite unlike Fort Benning, is

not categorized as a VOLAR post and, as a consequence, is not a recipient of funds appropriated for the purpose of implementing changes or testing ideas. Because of this situation, changes such as replacement of "GI" kitchen help with civilians and renovation of inadequate barracks, which are important to the "GI," have not been implemented. How important to the MVA mission are these prospective changes? Do you think the program may have missed its mark by emphasizing beer in the mess hall and longer hair when changes are vitally needed in other areas?

CMS: No, I don't think the program missed the mark. Beer in the mess hall and longer hair were a place to start. The more significant changes that are being considered are still being tested under the provisions of the VOLAR experiment. Once a determination has been made about the relative merits of certain changes, I'm sure monies will be appropriated to have them implemented Army-wide.

ENGR: VOLAR is said to be working in the 197th Infantry Brigade at Fort Benning, Georgia, where MVA-proposed changes are being implemented and tested. What are your opinions about VOLAR? Will it strengthen professionalism as it is intended—or will it attract people other than those high quality individuals at whom the program is aimed?

CSM: Well, VOLAR is strictly a test program, and as such I couldn't do it justice with an evaluation at this point. I will say that the idea behind the program is sound and when the testing is over I'm sure we'll see some changes in the MVA program.

ENGR: Comments from a few old "Brownshoe" Army types, and adverse publicity in the news media imply that the MVA program has gone too far in "loosening the standards" which have traditionally been associated with Army life and has, as a consequence, undermined discipline.

CSM: I'm an old "Brownshoe" man myself, and I don't think there is a widespread discipline problem. There are, have been and will continue to be occasional local problems, but they are resultant from poor leadership or bad attitudes among incompetent or inflexible officers and NCOs. You see, the standards have not lowered. They've just been modified to suit the times. I've adapted and made adjustment without lowering my personal standards, and I can't see why others who call themselves professionals can't—or won't—adapt. These are the people who cause problems—the kind of so-called leaders who, because a man can now have longer hair, say: "The hell with all of it! If he can have his long hair, I don't care what he does anymore." It's all a matter of professionalism.

ENGR: The discipline question brings us right back to that old intra-system conflict over the relative merits of the hardnosed negative incentive—"do it or else!"—approach to getting the job done, as opposed to the positive incentive or reward type of motivation which the Modern Volunteer Army program is concerned with developing. Do you think MVA will work, or do you think that the Army might have to re-adopt the old "Brownshoe" approach—much like the U. S. Marine Corps has maintained for the past 30 years—to accelerate its development into an efficient, capably led, highly competent fighting force?

CSM: Yes, I think the program will work because it is simply progress called by another name. The growing pains will be less severe if we all work together. It's just unfortunate that we have those few individuals who are dragging their feet and fighting change. This is a point about which I feel strongly—so strongly, in fact, that I will not recommend for promotion a man who demonstrates this attitude, regardless of his technical proficiency or career motivation. What we want and need most is the professional, not the run-of-the-mill careerist. ⊖

> **"...leadership schools back here in the states are essential for people in this category and can provide a base of training to compensate for that lack of experience characteristic of the 'instant' NCO."**

The Terrible Tempe

Application of the basic tenets of military engineering in Southeast Asia has not been without a generous serving of expedient and imaginative methodology. An interesting case in point is illustrated by the story of bridging the Ba Bep near Cu Chi in the Republic of Vietnam.

The Cau (Vietnamese for, among other things, bridge) Ba Bep project began as a normal mission requirement for elements of the 554th Engineer Battalion (Construction), 79th Engineer Group, 20th Engineer Brigade, during the peak of enemy activity in the Tet season of 1968. It entailed, very basically, emplacement of a small dry span over the Rach (river) Ba Bep where route TL8A, a main supply route (MSR) to the 25th Infantry Division main base camp at Cu Chi, intersected on its winding way to Phu Cuong.

Actually, the bridging requirement was a part of an elaborate road project in which the 554th upgraded the 16 kilometers of one-lane road between Cu Chi and Phu Cuong. And this project,of course, was just a minor facet of the vast Lines of Communication program of institutionalized engineer support of the pacification effort in the Republic of Vietnam.

What appeared on the surface, however, at the intersection of TL8A and the Rach Ba Bep—and quite literally had to do with "what appeared on the surface"—did grave injustice to the complexity and sophistication of the problems the 554th was to experience before the Ba Bep was to be bridged. In quite the same sense, it hid a mystery story that was about to unfold.

The Rach Ba Bep is a small tributary of the Rach Saigon and amounts to hardly a trickle in the dry season. The monsoon season, however, introduces the TL8A to another face of the Ba Bep with floodwaters from overflowing rice paddies and the agitation of tidal action transmitted up this small tributary by the Rach Saigon.

Approached problematically, the two faces of Rach Ba Bep and its diverse moods necessitated special care by the 554th when they designed and began to construct Cau Ba Bep.

Having spanned the short gap on schedule in early June, the 544th set about the task of stabilizing the approaches to Cau Ba Bep with laterite and coarse rockfill. They took extra care and time to comply with design specifications and despite a monsoon rain that had begun in earnest, completed the project without a hitch—almost!

Seven days after the Cau Ba Bep was opened to traffic, the north lane of the east approach mysteriously dropped a full seven feet.

Engineers quickly surveyed the damage and reacted to official pressure to reopen this "critical" MSR by stabilizing the area of failure by leveling with a D7 dozer. Without having actually identified the problem, they compacted the materials already in place and filled a second time with laterite and rock, reopening TL8A in 36 hours.

The day following, the north lane of the east approach again fell five feet; attempts to stabilize this approach two more successive times met with similar failure.

Some days and much fill later, surveyors noticed that, while the bridge abutment and pilings were intact

# of Rach Ba Bep

THE HENRY LARCOM ABBOTT AWARD

and immobile, the east side of the stream bed was heaving upward and out toward the center of the stream. Upon further examination of the bridge site, they discovered a fault in the surface of the ground just off the north side of the road through which dark, silty paddy clay was oozing.

A call went out to 79th Group Headquarters this time for a higher level assessment of the problem. The decision made to answer that call, based on the necessity to keep this MSR open, specified a more sophisticated variation on the stabilization approach—with emphasis on preparing the subgrade for the subbase fill.

The subgrade was attacked with leveling, scarifying, stabilizing and compacting before eight huge 290M scrapers made half a day's worth of passes at it with bellies full of laterite. But when surveyors evaluated the progress of six hours of continuous filling, it was discovered that the approach had actually—and very mysteriously—defied hundreds of cubic yards of fill and dropped a foot.

The 20th Brigade Headquarters, having been kept abreast of the now infamous Cau Ba Bep, dispatched a team of geologists and soils experts to the bridge site. They arrived to be greeted by not only the commanding officer of the 544th, but also the very considerable failure of the west approach to the bridge.

The team of puzzled experts began to closely scrutinize the area and local roads. They shortly discovered the interesting phenomenon to which the problem was to be attributed—50 thousand years of buffalo chips sitting on a huge subsurface stabilized plane.

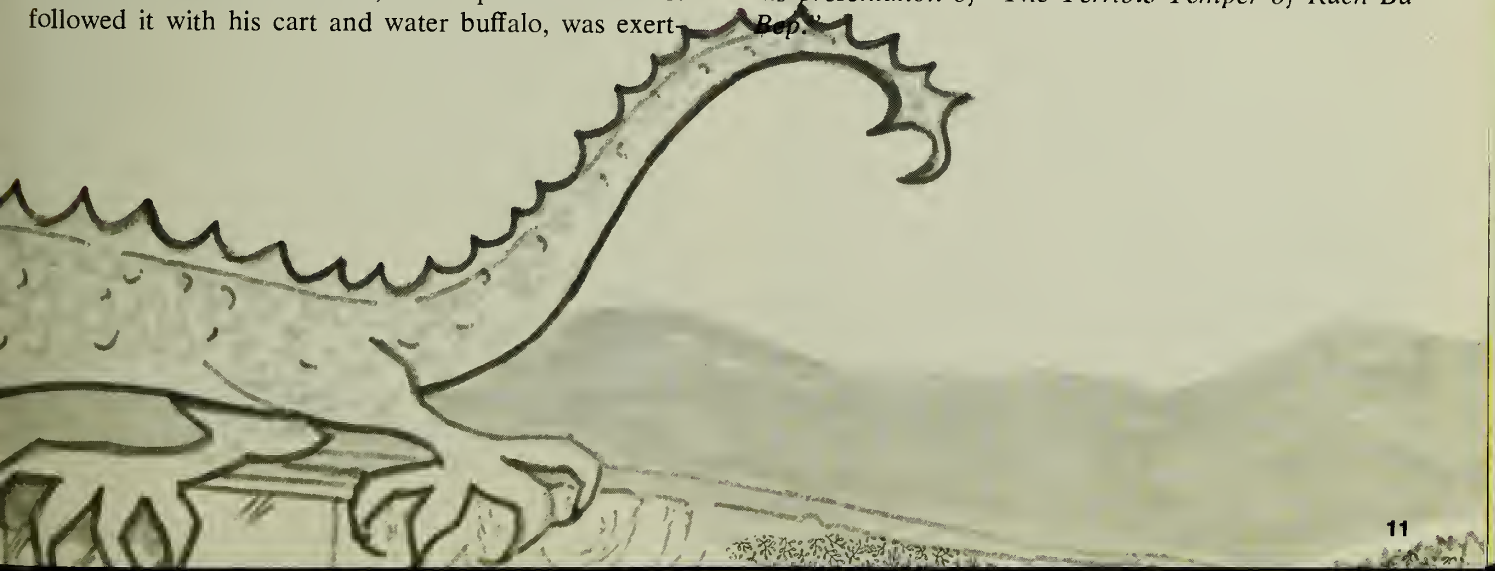
The old one-lane roadbed, built up since man first followed it with his cart and water buffalo, was exerting enough force perpendicular to the plane to stabilize the south side of the new road bed. The new laterite lane, however, was being filled with rock and laterite that began to displace the silty, fluid paddy clay to the area of least resistance—away from the "dam" created by the old roadbed and perpendicular bridge abutments, across what had now become a classic "slip" plane through the surface of the rice paddies to the north.

Having now identified the problem, the experts consulted their cone penetrometers and slide rules and came up with a solution—surcharge. They suggested very simply a blast rock and earth fill on the open north end of the "dam" to create sufficient force perpendicular to the subsurface plane to "contain" the clay in a roughly rectangular perimeter.

The 544th began to implement the plan with care, first stabilizing the banks of the stream to insure that it would not be closed by sliding mud. They then filled an area approximately 100 feet by 200 feet on the north side of each approach with a primary layer of blast rock and a secondary layer of rock and laterite mixture. In only 20 days they had completed the project and TL8A was open into Cu Chi.

The terrible temper of Rach Ba Bep had been curbed!

Captain Gary D. McDonald is a recent graduate of the Engineer Officer Advanced Course at Fort Belvoir, Virginia. A Vietnam veteran and career officer, Captain McDonald was recently presented the Henry Larcom Abbott Award for excellence in writing based on his presentation of "The Terrible Temper of Rach Ba Bep."



CCE—

The first time most U. S. Army Construction Engineers were able to get a real handle on the relative merits of military and commercial equipment was after the big buildup began in Vietnam back in mid-1965.

In those days of the early going, our Engineer construction units that deployed to Vietnam were equipped with "Army equipment." At the same time, civilian contractors were coming ashore to get the same job done with Commercial Construction Equipment.

It did not take a mastermind to figure out the difference in the equipment. As construction progressed, the military engineer could look about with envy at the contractor's equipment. All he had to do was compare the production potential and efficiency of his machines with that of the contractor's commercial machines. The military equipment came out second best.

Whenever an engineer construction platoon leader, his company commander, or his battalion commander felt the pinch of tight construction schedules or the rigors of heavy and complex construction, that individual could look over his shoulder at the sight of the contractor's equipment and begin dreaming of bigger and better things.

The dreams first became a reality when MCA-LOC (Military Construction Army-Lines of Communication) equipment was introduced to select engineer units that were committed to Vietnam's highway lines of communication construction in 1968. The MCA-LOC equipment consisted of some 28 separate items of commercial construction equipment that the U. S. Army Mobility Equipment Command (MECOM), St. Louis, Missouri, procured with Military Construction funds.

Even though there was a valid need for the items to complete the planned LOC on time, it took a lot of paperwork to get the desired results. Direct Support and General Support maintenance and support of the MCA-LOC equipment was provided by contract to assure maximum availability of the equipment. Then the requirement for the equipment was worked up and instigated in Vietnam and submitted directly to MECOM. It took approximately two months to analyze these requirements and another two months to solicit proposals from manufacturers and finally award a contract for the desired items. Delivery time varied from three to six months—making the total cycle time from receipt of the requirement to fielding of the item between seven and 10 months. Because of the urgency of the requirements, contract awards were based on a manufacturer's ability to deliver an item within the shortest time frame.

There are three basic ways the Army can obtain construction equipment.

- It can develop its own. Under this program, the Army can design its own equipment to meet all requirements—mobility, transportability, use in varied and extreme environments, maintainability, storage, and so on. It also can take maximum advantage of standardization and compatibility with other Army equipment. This system is generally used only when there is a requirement for an item that is not available commercially. The 20-ton rough terrain crane, for instance, is the result of Army research and development efforts.
- It can take a commercially available construction item and modify it to meet the various Army requirements. The popular 830M and 290M Medium Wheeled Tractors found their way into the Army inventory in this manner. Actually the majority of all the construction equipment in the Army inventory falls into this category.
- It can go "straight commercial." This method is indicative of the Engineer Family's current thinking.

There are advantages and disadvantages to all three alternatives. But it is the disadvantages that come to mind first when any piece of equipment is being criti-

Major Gerald M. Tippins

IMPOSSIBLE DREAM?

cized. This is especially true when that equipment is associated with poor job performance.

It is a fact, of course, that military-designed construction equipment serves its intended purpose. But this type of equipment usually has some obsolescence built into it relative to the civilian industry since the Army research and development cycle takes time to come up with the finished product.

After a military design item is fielded there is a tendency to keep it as long as possible. On the other hand, civilian contractors are taking advantage of technological advances in their equipment year by year.

Repair parts also can be a problem, especially when they are designed characteristically for the military. These parts will be produced only on military demand and, if and when the balloon goes up, there will be a time lag in supplying them to the field. The military-adopted or military-modified commercial item has many of the same problems. The Army investment in development for the modification is usually considerable because of what follows. Basically, for every modification that is made to a commercial item, a military peculiar part is introduced into the system. The extent of the modification of the commercial items varies from item to item. Then too, there are extremes. One such extreme, for example, is the military adopted 20-ton Lattice Boom Crane. This item is reported to have 40 percent of its parts modified to meet military requirements. Yet for construction purposes, this crane does no more than its commercial counterpart. The manufacturer stocks 60 percent of the parts for the crane for all of his customers, while the other 40 percent is provided only on military demand.

The Army's appetite for Commercial Construction Equipment was whetted when it began using MCA-LOC earmarked equipment. There should be a way to get the commercial off-the-shelf equipment into the hands of our construction troops on a routine basis. It is not possible to go the MCA-LOC route because MCA funds can not be used routinely for equipment buys under current regulations. Today, more competition in procurement must be recognized because the urgency for new items is diminishing with the phase-down of the war in Vietnam. Therefore, the possibility of awarding contracts based on the manufacturer's ability to deliver is gone and, in fact, will not be needed. Now the items will have to be supported in a peacetime environment where contract maintenance support may be too costly. This means that the military will have to begin placing more reliance on the Defense Supply System. The Army anticipated this problem four years ago.

In 1968, the Department of the Army (DA) organized an Ad Hoc Working Group to establish policy on the use and procurement of Commercial Construction Equipment. The DA policy was to include implementation procedures for expeditious adoption and assurances that any procured equipment would be of the highest quality.

After the results of the Ad Hoc Group were staffed at DA level, they were published in a policy and guidance letter in August 1969. The Army Materiel Command (AMC) in coordination with Combat Developments Command (CDC) and Continental Army Command, developed a detailed implementation plan for the DA policy. Coordination of this plan at DA level resulted in the program that is generally followed today.

How does it all work? Briefly, the cycle for fielding a commercial item starts with the CDC Engineer Agency at Fort Belvoir, Virginia's, initiation of a requirements document. The document is designed to completely describe the commercial item that is needed. This requires close coordination between CDCEA and the U. S. Army Mobility Equipment Center, which is also located at Fort Belvoir.

The document includes two important pieces of information—a planned basis of issue (BOI) and a rationale for the type and size of the desired piece of equipment. The BOI is critical at this point since it significantly impacts on the cost effectiveness for the item. This must be shown before DA will approve a "go-ahead" to procure it. The goal of the program is not only to introduce the modern up-to-date commercial equipment but also to reap all the benefits of increased productivity and efficiency that will provide a maximum savings in manpower.

After the requirements document has been coordinated through the major commands, it is forwarded through DA for approval. Once the document has been approved by DA, the Army Materiel Command develops an item description and sponsors a Request for Technical Proposal from industry.

Then a field evaluation of the commercial items proposed by industry is conducted at civilian job sites by the U. S. Army Test and Evaluation Command (TECOM). All evaluated items must have been in general use by the construction industry for at least one year. This requirement has been instituted to take maximum advantage of the R&D work of the civilian industry and to minimize formal Army testing.

There is a statement which is repeated time and time again. "Contractors are using this equipment every day and making money. The Army should just go out and buy it." While this may be true, the field evaluation insures that there is only a minimal risk involved with no formal testing. One should keep in mind that Department of Defense procurement policy is to "Fly Before You Buy."

So after the evaluation is completed, successful candidates are then asked to submit a bid and generally the award will be given to the low responsive bidder. The successful bidder's item of equipment will then be type classified Standard A. The Defense Construction Supply Center will be the contracting activity and will provide for the support of the item once it is fielded. The item will normally receive the same type of support that is given to all other items of equipment in the Army inventory. The only noted difference that will be felt in the field will be that the using unit will have to make use of cross reference files to convert manufacturers' parts numbers into Federal Stock Numbers (FSNs) before it can requisition repair parts. Under this system, the fast-moving parts will be stocked and issued upon demand. For items that are not stocked because of a low demand or are out of stock, separate open-end contracts with manufacturers may be used to get quick delivery of the repair parts.

Currently, the Army is well underway with a program that is designed to "try out" the latest implementation plan. Three items are being used in this pilot program—a 25-ton Hydraulic Crane, a 1,500-gallon Bituminous Distributor, and a 20-ton On-Off Highway Dump Truck. These items will replace the 20-ton Truck Mounted Crane, the 800-gallon Bituminous Distributor and the 5-ton Dump Truck now being used by construction units.

The program, as presently envisioned, applies only to the construction battalion, construction support company, port construction company, dump truck company, engineer equipment operating teams, engineer utility teams, and in some cases, light equipment companies.

Speculation grows that once the items are introduced into the system, the basis of issue will eventually include more engineer units and even units of other branches when appropriate.

The initial program is moving slowly. Although the procedures do not seem to be grossly different from those that exist today, many decision points have been reached and a lot of problems have been aired and

explored. Case in point—the 25-ton crane is only about halfway through a planned 31-month-cycle from initiation to actual fielding. The field evaluation is currently underway and fielding is scheduled for July 1973. The other two items are currently scheduled to follow close behind.

To prevent any time lag once the pilot program really begins to roll, CDCEA has already initiated requirements documents for other items. These include requirements documents for high speed embankment compactors, self-propelled vibratory rollers, self-propelled rubber-tired rollers, heavy and extra heavy crawler tractors, equipment transporters, backhoes, and large front loaders. Also under consideration is a full array of equipment that will provide the Army's construction engineers with a modern, efficient fleet of equipment.

This is all very interesting but what are the ways this program can be judged and measured in terms of success? It can be termed a success if the Army can ultimately get the commercial equipment off-the-shelf and into the hands of the construction troops. But what about the support? Obviously if off-the-shelf equipment is fielded and not properly supported, the program will not be a success. Some experts may want to measure the program's success in terms of time. If they compared the predicted, perhaps optimistic,cycle time—from CDCEA's initiation of the requirement to fielding in 31 months—with other Army construction equipment programs, this could be called a success. Programs involving development of construction equipment could take longer than five years to show the end product. Programs involving military adopted or modified commercial equipment also can take as long before an item is type classified.

The CCE program would be termed successful when it is compared to the other programs. However, if the experts would look closely at the seven to ten months it took to field the MCA-LOC equipment, they might feel that the program is still lagging in some respects.

Shortening the cycle time is still a sought-after goal. Aside from what has already been mentioned about shortening the cycle time, there is still another unique aspect of the program. A permanent Ad Hoc Working Group has been established to monitor the program and to recommend and execute changes that will streamline and perfect it.

The Ad Hoc group meets regularly at Fort Belvoir and is currently investigating ways to shorten the time that is required to initiate a requirements document and get it approved by DA. The group has already found a method that, if approved, would cut the present processing time in half. Even more dramatic, of course, would be a way to get relief in the area of type classification. The group claims that if the type of technical evaluation that was used in the MCA-LOC program were used, as much as six months could be chopped off the program. This probably will not work since existing regulations relative to type classification are very specific about the evaluation of an item that must be certified as "suitable for Army use" by TECOM. The Ad Hoc Group also has asked AMC to take another close look at all possible ways that the procurement cycle can be reduced. The group additionally plans to take a hard look at relative cost or effectiveness of the maintenance support of the MCA-LOC equipment as compared to support of standard equipment.

If this intensive care continues on in the program, the first item will certainly be fielded. This is of paramount importance to cast the die. It is expected that a more vigorous program will continue to evolve as it is massaged into the most efficient and practical program the present-day Army can have. This type of forceful procurement program is needed for the Army to obtain the best equipment for the engineers so they can do their job in the challenging years ahead. ⅇ

Major Gerald M. Tippins is currently assigned to the Materiel Requirements Division, Engineer Agency, U. S. Army Combat Developments Command, Fort Belvoir, Virginia. He has held a number of construction engineer assignments that included tours with the 293rd Engineer Battalion in Germany and the Lines of Communication Division, Construction Directorate, Military Assistance Command, Vietnam. The major is a 1961 graduate of The Citadel, Charleston, S. C.

SHADES OF JOHN HENRY

steel driving men

Tying modern America to its colorful past has been a source of many of our nation's finest collective efforts. Indeed, it is a theme that pervades virtually every aspect of the American existence—from blues music and politics to fairy tales and mountain moving.

And when Americans think in terms of achievement against monumental odds, they think collectively of the nation's most celebrated rural folk hero—John Henry—the steel driving man.

It was John Henry, so the stories go, who in the middle 1800's matched his own strength against a steel driving machine on the railroad and lost. But John Henry's tremendous losing effort is what people remember about him today. He fought against the odds and lost but won the hearts of his countrymen.

The theme has been carried along through the centuries by each new generation of Americans and today we consider any difficult effort one of the mainstays of our rich heritage. Giving it the "old college try" is as American as bubblegum and baseball. And it is the motto of the Corps of Engineers—Essayons—"Let Us Try."

One of the Corps' units, for example, gave out with the old try not too long ago. The 562nd Engineer Company from Fort Richardson, Alaska, was given a task that had been attempted without success three times in the past. A crack separate outfit and winner of the Itschner Award in 1961 as the outstanding Engineer Unit in the U. S. Army, the 562nd was asked by State Department of Parks officials to construct a 45-foot steel stringer bridge over the Eklutna River Drainage Basin in Eklutna, Alaska.

The base for the selected site was almost solid granite. What was not rock might as well have been. Permafrost—a permanent fixture in the world's cold regions—had frozen the earth hard enough to make steel picks bounce off like jack balls.

The task of driving timber piles into a surface this hard looked like an enormous job. Indeed, civilian officials at the scene from the Alaskan Bureau of Land Management were convinced that the bridge was an impossible task.

Although it is difficult enough to perform any kind of construction in extreme cold, the 562nd was not about to give up without a try. It was decided that demolitions and steel tips fastened to the ends of the 40-foot-long, 18-inch-wide piles would have to be used to break that surface. The goal was to sink the piles eight feet into the granite mass.

With the help of 100 Engineers, 50,000 pounds of material, and 300 tons of equipment, an attempt was first made to drive a single pile without demolitions. The pile sank two feet and then snapped and shredded. This was not a wasted effort. The 562nd had found a swift way to make large quantities of firewood. Shaped charges of ammonium nitrate were then brought up from the rear to provide "beginner holes" for the massive creosoted piles.

When the first 40-pound charge was set off at the proposed bridge site, there was little evidence of any depression when the debris had settled—only a puddle of water 18 inches deep and 2 feet wide.

The Engineers kept up the barrage and the piles slowly began to sink into the unwilling surface.

After three weeks of concentrated effort, 562nd personnel were able to drive the eight main piles eight feet into the frozen surface, construct end dams, and place four 7,000-pound steel stringers in position over the 20-foot-wide glacial stream.

Long working hours were the order of the day as the structure began to take shape. The 90-foot-long, 16-foot-wide frame was dressed with eight-inch-thick treadway, two and one-half inch decking, four-foot-high handrails, and six by six inch curbing. The finished bridge weighed some 42,000 pounds. The construction price was about $50,000.

The bridge represented not only a fine achievement but also a first for the Engineers in Alaska. This was the first time they had ever constructed this particular kind of bridge in that state. Completed on June 24, 1971, some five weeks after the 562nd "broke granite," the bridge has opened a new permanent route for campers to the southeast corner of Eklutna National Park. e

RATED "P" FOR PROFESSIONALS

Captain Dennis F. Pierman

On a damp Winter morning in central Missouri, fog creeps from the Ozarks, as Carl Sandberg reflected, "on little cat feet." It tumbles and boils its bone-chilling shroud over the fingers of leaf-less trees, carrying the odor of mulch and sod with it. Into Fort Leonard Wood it quietly slips at first light, turning off-white clapboard barracks into ochre sentinels end on end.

The ghost of ten thousand reveilles clears a brassy throat as dawn makes its feint at the fog. But the fog "sits looking on silent haunches", waiting for the bugler's first staccato note to assault the sounds of silence.

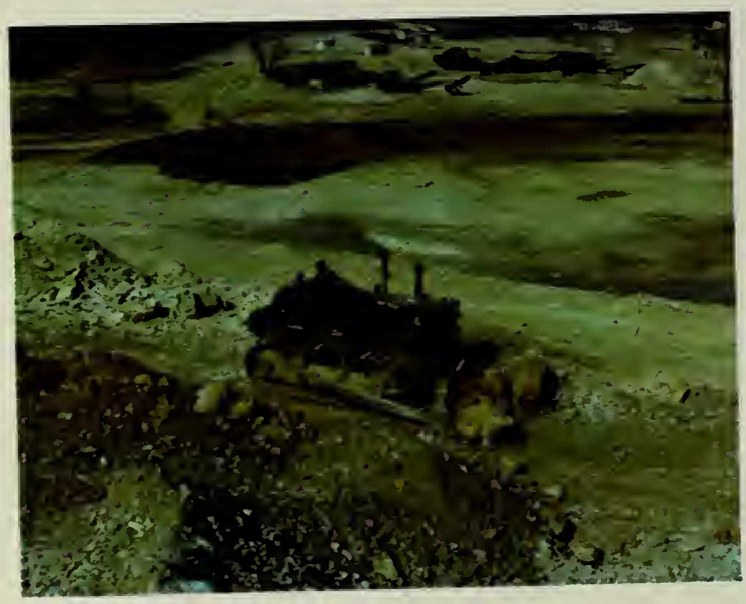
This morning, "Reveille" introduces nothing more than the time of day to those interested enough to be listening at 6 a.m. To the disappointment of a lurking fog, row upon row of lapstrake hulks, neatly dressed and covered, stand the only reveille formation on Fort Leonard Wood.

Reveille, to the chagrin of old "First Shirts" everywhere, has died the same death, it seems, that white side-walls and spit shining died with the "snicker-snack" of the Modern Volunteer Army Program's broadsword. That invincible giant, tradition, is being carefully dismembered to make way for a streamlined, contemporized Army whose new mainspring is synchronized with a changing America.

The Army is changing in the wake of progress, addressing problem areas with programs such as the Modern Volunteer Army Program (MVA) and VOLAR, a controlled testing program designed to expand the volunteer, professional base upon which the structure of the Army is based. Because MVA has a wider, more universal application to the mechanics of the Army system, it warrants close examination by organizations Army-wide.

The Modern Volunteer Army program, designed basically to develop the Vietnam-era Army into an

The 4th Engineer Advanced Individual Training Brigade maintains this huge open-earth training area in the heart of Fort Leonard Wood. Pictured on these two pages is a sampling of the diverse, equipment-oriented training that one will encounter on an average training day in the "Million Dollar Hole."



THE MILLION DOLLAR HOLE

efficient, capably led, highly competent fighting force, necessarily plays an important role in the training environment and is easily dissected in units such as the 1st and 4th Engineer Advanced Individual Training Brigades at Fort Leonard Wood, Missouri.

It is this level, the second 8-week increment of a soldier's first 16 weeks of introduction to the Army in living color and stereophonic sound, that the promotional effects of the accessions system and that initial introduction to the MVA are put to a critical test.

It is during this period of indoctrination and rudimentary introduction to a military occupational specialty that the prospective careerist tries on the Army's multi-media, multi-million dollar advertising campaign for size—does today's Army really care more about what he thinks than how he wears his hair?—does that Army really want to join *Him?* This is the period during which that unique consumer tries it all first-hand, developing impressions that are sometimes an indelible influence on his vulnerability to the professional mystique. If the MVA succeeds in the development of a salable product to market at this level, that prospective professional will have been effectively exposed to attractive career prospects. If it does not, the young soldier who is a "high quality individual" will have been lost to civilian enterprise before the contest for his energies has even begun.

MVA, of course, has come to Fort Leonard Wood as surely as it has to installations throughout the world. It was recently examined in the 1st and 4th Engineer Advanced Individual Training (AIT) Brigades at that post to provide **the engineer** with insight into controversy about the program.

Initially, it was discovered in interviews with a cross section of permanent party personnel that inconsistency in the application of changes for one unit to the next is most aggravating. This failure to establish a "universal" application of needed reform—a failure based on non-availability of funds Army-wide—coupled with a politically uncomfortable "institutionalization" of a long awaited program of reform, has become a subject of concern and a basis for heated argument.

Examination of MVA in Fort Leonard Wood's two engineer training brigades was preceded by an introduction to the local application of the program— a la post MVA project officer. He simply reiterated a by-the-numbers presentation in pamphlet form "The Fort Leonard Wood Scoreboard for the Modern Volunteer Army"—indorsed by the post commander, Major General W. T. Bradley. It contained, in the first few pages, excerpts from Army Chief of Staff General W. C. Westmoreland's address to the Army Commanders' Conference of November, 1970, in which he established guidance for the Modern Volunteer Army concept.

"I expect commanders at every level," he directed, "to take rapid and positive actions which will enhance service attractiveness and remove irritants to the troops —We are willing to part from past practices where such practices no longer serve a productive and useful end—Nothing is considered sacrosanct except where military order and discipline . . . are jeopardized—"

The remainder of the "Scoreboard" for Fort Leonard Wood illustrates examples of recently implemented changes common to most post activities Army-wide as a result of the Westmoreland edict.

Eliminated—

- Revielle formations except for ceremonial training or other special occasions.
- Local requirements for the pass form (DA Form 345.)
- Bed checks except for control and personnel undergoing punishment.
- Unnecessary troop formations and curtailed "hurry up and wait" activities as much as practical.

Established—

- A five-day work schedule, with modification for BCT units.
- Short order meals in the messhalls for weekends.

Proposed—

- Civilian kitchen attendants to replace soldiers on KP duties (contingent on funding.)

Leonard Wood's MVA action officer added, "What hurts so badly is that old stickler—lack of money. Fort Leonard Wood has the unhappy circumstance of not being VOLAR funded (i.e., recipient of specially appropriated monies for promoting an All-Volunteer Army.) As a consequence, we can't put our effort into critical areas such as barracks renovation and the like which are necessarily expensive. We could, of course, put our backs into it and do that kind of thing ourselves, but we would run into trouble with the civilian community to which this sort of thing is normally contracted. A small town such as Waynesville (Missouri) is like Fayette, North Carolina or Columbus, Georgia, in that it is dependent on the military installation in its locale for the livelihood of many towns people. No one wants to violate an existing policy of sound community relations and return Fort Leonard Wood to its place as a self contained 'little Korea' as some old-timers had once labeled it."

Close examination of MVA within Leonard Wood's two Engineer training brigades necessitates an evaluation of each brigade, its special mission, the type of student or trainee with which it deals, and its cadre.

The 1st Engineer Advanced Individual Training

Brigade, once known as the U.S. Army Training Center, Engineer, 1st Training Regiment, is the only unit in the Army which offers combat engineer training. Functional areas with which its training deals include construction, combat arms and combat support, each of which is a facet of the complicated role of the Table of Organization and Equipment (TO&E) combat engineer. Specific engineer instruction, accomplished through a committee system, includes map reading, engineer tools, panel and timber bridging, river crossing operations, and expedient construction of roads and culvert systems. "Combat" training covers land mine warfare, field fortifications, explosives and demolitions tactics and weaponry. In addition, under provisions of the Skill Development Base Program, the 1st Brigade has operated the Combat Engineer Noncommissioned Officer Candidate Course which is being phased out to accommodate Fort Belvoir, Virginia's new Engineer Noncommissioned Officer Education System (see **the engineer,** Winter 1972, Vol. 1, No. 4.)

The 4th Engineer Advanced Individual Training Brigade, on the other hand, represents a departure from the combat engineer theme in providing the Corps of Engineers with its heavy equipment operators and engineer soldiers with construction-oriented skills such as blasting (Powderman Course), utilities and plumbing, carpentry and the like. But its most spectacular enterprise is its Heavy Equipment Operators Course and Training Area 256; part of the "Million Dollar Hole" where, on an expanse of open earth work resembling a huge quarry operation, row upon gargantuan row of cranes, shovels, scoop loaders, drilling machines, tractors and the like rumble and crunch through the training day.

Because the training mission of each brigade differs so significantly from that of the other, it is not at all unusual that one finds two generally diverse groups of trainees in the enlisted and drafted (RA and US components) categories. The combat engineer in the 1st Brigade, because he is by definition of its military occupational "specialty" a generalist, seems less sophisticated and less highly motivated than the prospective specialist who is undergoing more specialized training in the 4th Brigade as an equipment operator or tradesman.

The great equalizer, however, appears to be the large percentage (sometimes 90 percent) of enlisted Reserve and National Guard (ER&NG) trainees in both brigades. Their attitudes, because they are only on temporary active duty and generally have a higher formal education base, have a universally positive and stabilizing effect on their RA and US contemporaries whose perspective is strongly influenced by active duty service obligations of two or three years and a significantly lower average formal education base and average age.

A basic flaw in the program is apparent at Fort Wood as it must be elsewhere; one unit, the 4th Brigade, grabbed the brass ring and found itself in new modern brick barracks while its sister element, the 1st Brigade, maintains the old frame "T" variety and its characteristic headaches. The resultant contrast, because it is in an area so elementary, establishes an argument for uniformity.

An articulate and concerned officer from the operations shop (S-3) of the 1st Brigade put it this way, "The 4th Brigade people are the lucky ones. We here have not only the complicated administrative and training problems common to both brigades but also the sometimes impossible task of motivating a trainee whose barracks is not fit for human habitation. For example some of the heaters don't work. So in subzero weather, I would guess, indoor temperatures are far below the 70 or 72 degrees they should be. The wiring is old and inadequate and the plumbing is in the same sorry state. And there isn't a lot we can do about it with no money and regulations that prohibit extensive renovation of the "T" buildings. We are violating a basic pyramid of human needs principle by not providing these men, who as combat engineers spend a great deal of their training time out in the weather, with adequate shelter and simple creature comforts.

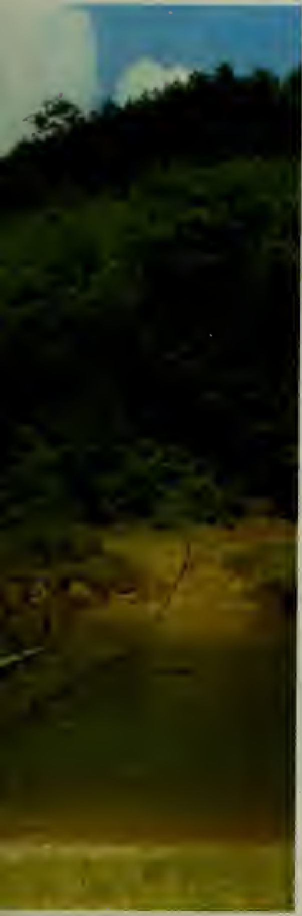
A staff officer in the 4th Brigade commented to that end saying, "Yes, it is too bad there wasn't enough money to get all of our engineers into these new buildings. I can understand the kind of a problem those old billets constitute for the 1st Brigade—especially when some of their trainees have had the new accommodations a few weeks earlier as basic trainees right here at Fort Leonard Wood."

Trainee perspective about MVA is limited in scope, but one of casual interest permeates both brigades. The difference in billeting is mildly controversial, but actually of little consequence as they are too busy training to get into philosophical arguments about it. And having had no exposure to the 'old' Army, their expertise is rather valueless based on an ability to compare a change to a point of order discarded sometime before they were inducted."

Cadre, however, had some rather strongly worded comments about the changes introduced by the MVA program.

"Institutionalizing this program of changes and giving it an official, high level 'handle'," said one 1st Brigade Drill Instructor veteran of 18 years in the Army, "has turned many people off. I'm of the opinion that things are getting too centralized back at Department of the Army level. Things that should and have been

The 1st Engineer Advanced Individual Training Brigade trains engineers. Pictured here from "high noon" counterclockwise to seven o'clock are combat engineers assembling an aluminum floating foot bridge, trainees crossing the finished footbridge in combat gear, and a combat assault from fiberglass assault boats on the Big Piney River. The 4th Brigade conducts training of a more specialized application as exemplified by the Carpenter Course. Pictured at the right, a 4th Brigade instructor shows trainees the correct way of nailing, sheathing, and bridging on exterior walls. In the bottom center photograph, an instructor assists trainees in installing hip jacks and valley jacks on a "hip and valley roof."



VINTAGE 1972: A GOOD YEAR FOR TRAINING AT FORT WOOD

company-level determinations—like sign-in/sign-out policies and haircut regulations—have been taken away. This hurts us here in the training company and impairs our ability to accomplish our mission because our authority has been usurped by the Pentagon.

"But for the most part, I think the MVA approach is basically a sound one and the resultant standardized changes are awkward but essential while the Army is in a state of flux as Vietnam 'winds down.' It just makes the job of the training cadre a little more demanding. But, then, that is what I'm being paid for in the first place—to accomplish the mission as directed."

Comments about the caliber of the engineer trainee at Fort Wood, how he differs from the trainee of the post Korean War period and his "trainability" were consistent from one brigade to the other. Cadre personnel saw him as more highly sophisticated, better educated, and easier to work with than his predecessor. Black and white overkill in the lecture phase of instruction, because even "average" trainees can be used as "assistant instructors," is no longer an evil necessary to accommodate the occasional slower learning trainee. This has given rise to "hands on" training, the training brigade jargon for practical exercise employed to the maximum. This is a more practicable kind of teaching vehicle and much more satisfying to the trainee who is, in many cases, working overtime simply to adapt to Army life.

Other recent changes in training emphasis have, as part of the MVA effort, had significant impact on the trainee, his cadre, and the Army. As exemplified by a conservation project involving engineer trainees of the Skill Development Base in the 4th AIT Brigade, training has a new practical slant that generates that rare commodity known as job satisfaction for trainees and cadre alike.

Working in conjunction with the Fort Leonard Wood Post Engineer activity, the 4th Brigade launched wildlife habitat improvement project for rabbit, quail, and other species of local small game about 17 months ago. The project, which involved improvement of land belonging to the Army and a National Forest, was completed in late Spring 1971 after extensive work by 4th Brigade trainees operating tractors, dozers, and Rome plows. The trainees incidentally rotated into the work schedule on a daily basis to give as many individuals as possible a chance to get involved.

The 1st and 4th Engineer Advanced Individual Training Brigades at Fort Leonard Wood, Missouri, have been tempered by nearly two years of MVA-propelled changes since General Westmoreland outlined his initial proposal for a Modern Volunteer Army. The challenges associated with implementing these changes during this critical period in a trainee's development have been demanding, but met with the kind of strong professionalism which MVA hopes to engender Army-wide.

"The new trainee may have long hair and classroom episodes low key compared to the trainee of 10 years ago," commented a Drill Instructor typical of the cadre from both brigades, "but he is much easier to work with and to motivate. It's sometimes tough on me now that a man is encouraged to ask 'why' and to risk a barrage of 'sharp shooting,' but it's really good for me because it motivates me to keep abreast of things which I might otherwise have let slide by. I just have to keep sharp, know my job thoroughly, and use my head. Those old-timers who've been 'ghosting' for years and getting by with it by intimidating the young enlistee or trainee with a couple of stripes are going to be slow to adapt and will just fall under the ax as the post-Vietnam Army gets peacetime 'svelte'."

And that is the honest truth of it. A change has been directed and change the Army will. The engineers, alive and well at Fort Leonard Wood, have "gotten with the program," as have true professionals throughout the Army, and have risen to meet the challenge of creating a Modern Volunteer Army. Training has become more effective, the trainee more trainable now that his dignity as a human being is his to maintain as a matter of universal policy while the Army itself has become more acceptable as a prospective career for today's youth. But there is still a long way to go before all the problems are identified and resolved. The 1st and 4th AIT Brigades are into the fray and helping the Corps of Engineers maintain its reputation as a highly progressive, professional component of the U. S. Army.

As a kind of postscript to our examination of MVA and training at Fort Leonard Wood, it must be added that lessons learned in the last year and a half have caused people such as Brigadier General Ira A. Hunt, Jr., Director of Training for the Continental Army Command, to take a second look at changes implemented in training centers. Emphasis has now been placed—effective mid-February—on an "austerity" common to the pre-MVA training environment and a more vigorous training (PT) oriented curriculum.

It is anticipated that this old variation on an older theme will revitalize training and make it more "palatable" in the long run to both the Army and the trainee. Perhaps the trainer and trainee alike have discovered that beer and mashed potatoes, mixed well with psychedelic music and posters, garnished with plenty of sleep and week-end passes, make GI Joe a dull boy. In any event, time and the Army march on. **The Editor**

VERSATILITY IS THEIR THING

ENGINEER STAFF

A U. S. Army combat engineer battalion is geared to perform many tasks that augment the mission of friendly forces in an unfriendly environment.

According to the Army's definition, combat engineer battalions are highly efficient outfits that are capable of aiding the operations of "friendlies" in a variety of ways. They can erect tactical bridges, build tactical roads and airfields, clear mines, and perform reconnaissance. These outfits also know how to use demolitions to impede the enemy—by blowing up his bridges, roads, and airfields.

So what, then, is the mission of the combat engineer battalion stationed in the Continental United States? Is it solely to maintain a training program to intensify the engineer skills of the individual engineers assigned to that unit?

No! In reality, the role of a stateside combat engineer unit is far more diversified than one might think. Even though military occupational specialty training is essential, the skills of the engineer lend themselves too readily to peacetime necessities to go unused.

But what might a specialist in bridging demolitions, reconnaissance, excavation, or rigging do to benefit a civilized and highly technical world at peace? The answer is—many things. With imaginative planning, combat engineers can accomplish many worthwhile projects such as improving recreational and educational facilities, helping civilian organizations or municipalities, providing training facilities for other units, or contributing to the upkeep of a military reservation.

A prime example of what a combat engineer unit can do when its capabilities are channeled in a positive direction is the "track record" of the 18th Engineer Battalion (Combat), stationed at Fort Devens, Massachusetts.

During the past several years the battalion has undertaken numerous on-post and off-post projects. Many of these projects have been in direct support of Fort Devens, both to assist other units and to aid the general operation of the base. For instance, the 18th labored to enlarge the Turner Drop Zone for almost two years in order to improve the training capabilities of the Fort Devens-based 10th Special Forces Group (Airborne). This project, which entailed the clearing of 278 acres of land, was a massive exercise in all phases of combat engineering. The project called for the utilization of every engineer skill because it involved the felling and disposal of almost 200 acres of trees, filling a large marsh, levelling steep inclines, and the installation of proper drainage.

The battalion also has supported in the general operation of Camps Drum in New York and Edwards on Cape Cod, Massachusetts, by initiating intense range rehabilitation programs. In addition, the 18th has upgraded roads and provided field construction to improve the training facilities at both camps.

In other projects such as the construction of the Fort Devens sanitary landfill, the 18th Engineers reflect the Army's sensitivity to the pollution concerns of the country. The sanitary landfill, which consists of four, 17-foot-high, collapsible berms, affords the post with a means of disposing of its refuse without resorting to the traditional incineration method.

In fact, ecological consideration has been given top priority treatment in the planning and execution of all of the battalion's projects. The Turner Drop Zone project is a good example. The ground there was reseeded and drainage ditches were strategically located to insure proper drainage.

Members of the 18th help landscape and extend the Fort Devens Golf Course.

Building demolition techniques also have been altered in the interest of the environment. The old practice of tearing outmoded buildings down to the base and leaving concrete foundation eyesores is a thing of the past. Now the buildings are completely razed, the foundation is removed, and the area is graded and seeded. This leaves an attractive plot of grass until that space is again put to use.

These considerations for ecology on the part of the 18th Engineers have paid handsome dividends for Fort Devens. The battalion's efforts have been instrumental in the post's selection as the winner of the Army Chief of Staff's Conservation Award for 1971. Fort Devens also was named runner-up for the Secretary of Defense's Conservation Award for 1971.

During 1971 alone, the battalion completed 68 projects designed to make the lot of the individual soldier happier during his leisure time. Members of the 18th extended and improved the Fort Devens golf course, built a horse training corral at the Fort Devens Saddle Club, improved the baseball, track, football and beach facilities, and constructed a patio for the Noncommissioned Officers Club.

The Army's contribution to the civilian community has recently been questioned by its critics. Many have asked, "Shouldn't the Army become more involved in the problems of the community they live in?" These critics should check the 18th Engineer Battalion's record. Its very mission charges the unit with providing general engineer support for the entire First Army area.

Civic action assistance is more than just a byword with the 18th. It assisted in the rebuilding of war-torn West Germany after World War II. And the battalion has lived up to its legacy during the past several years by aiding local civilian municipalities and organizations. When emergency conditions exist, it is a common sight to see members of the battalion on the scene providing assistance.

Personnel from the 18th improved this beach area at Mirror Lake.

Engineers from the 18th raze some old buildings to make the post look beautiful.

Engineers of the 18th have rolled out the heavy equipment on many emergency occasions to plow out a snowbound community during the harsh winter months in New England. Not long ago, the battalion provided engineers and heavy equipment for the dredging operation that was needed to clean up Spicket River near Fort Devens. After 130 tons of refuse was hauled away, this action provided recreational facilities for the surrounding area.

Like any good neighbor, the 18th has maintained a keen interest in youth organizations in the area and has helped them in many ways. The battalion provided a major portion of the support for the Fort Devens-conducted Project Summertime, a program that gave underpriviledged children from Eastern Massachusetts a vacation equivalent to any summer camp. Members of the 18th also constructed a youth center in Athol, Massachusetts, in support of Project VISTA, and cleaned up a playground in Lawrence, Massachusetts, for the Neighborhood Youth Corps.

All these achievements add up to proof beyond doubt that a combat engineer unit can and does function as an integral part of a society at peace. Every combat veteran knows the necessity for the type of support the combat engineer can provide in a hostile fire zone. The value of the combat engineer, however, is not depreciated by a Continental United States assignment. His skills are just as applicable to peacetime as they are to combat. The proper employment of those abilities can and have benefited both the Army and the country it serves.

PIER PROTECTOR

Captain Robert J. Oldmixon

Now you see it—now you don't!

In the blink of an eye, a high-explosive charge blasts away the supports from underneath a vital bridge. Downstream, dark figures move toward the shadows of the riverbank. After observing the effects of their carefully placed explosives, enemy sappers are quietly leaving the area . . .

The capability of the enemy in Vietnam to destroy bridges causes great problems for US and Republic-of-Vietnam forces, just as General Robert E. Lee's Confederate saboteurs a hundred years ago created problems for General Ulysses S. Grant's advancing Union troops.

With all the air capabilities of our present-day forces in a technological age, bridges remain about as critical to military communication as they were to army commanders a century ago. Unconventional (guerrilla-type) war tactics used by the enemy in South Vietnam—compounded by the large number of bridges required to support the country's transportation routes—have made protection of bridge structures a primary mission for Engineer units.

Two construction companies of the 92nd Engineer Battalion and the 41st Engineer Port Construction Company attached to the 92nd, began work on the 1002-foot Phu Cuong Bridge in October 1967. The bridge was opened to traffic nine months later. On November 6, 1968, North Vietnamese Army sappers, swimming undetected to the bridge, attached explosive charges to a pier. Minutes later the critical link of Main Supply Route (MSR) 25 between Long Binh Depot, Di An, Phu Loi, Cu Chi, and Lai Khe was crippled—after only five months of use.

A young North Vietnamese lieutenant named Nguyen Diem switched allegiance, rallying to the side of the South Vietnamese government only a few weeks after the sapper attack on the Phu Cuong Bridge. The new "Hoi Chanh" (defector), Lieutenant Diem had been executive officer of a highly-trained North Vietnamese Army underwater demolition company. He had been leader of the sapper team that hit the Phu Cuong Bridge.

Before the North Vietnamese Army would make him a lieutenant, Nguyen Diem had to complete two years of extensive training in swimming and underwater demolition in the port of Haiphong, North Vietnam. Although use of SCUBA equipment was among the things Lieutenant Diem was taught, he admitted that such sophisticated equipment was rarely available. He explained that sappers commonly used snorkels which

they made from sections of garden hose about seven inches long.

Lieutenant Diem used the snorkel while swimming in a sitting position, with his head tilted back beneath the surface of the water. He was taught to navigate in this position by kicking with a bicycle-pedalling motion, moving in the direction of the current while towing up to 500 pounds of explosive charges. The charges are often suspended with rubber floats at a neutral buoyancy approximately one meter below the surface of the water. Ordinarily a swimmer enters the water upstream of his objective through an unsuspected inlet. With the snorkel in his mouth, he makes his way to the bridge, ties off the charge and exits the river downstream in much the same manner as he entered. Meanwhile a chemical delay fuse, timed to allow the swimmer to reach safety, detonates the charge.

Two methods are used in disabling a bridge. A critical pier may be demolished by exploding a charge placed directly on it. If a large amount of explosive is available, it may be anchored on the floor of the river or to a pier protection system to create a blast capable of dropping a span.

The explosive required to drop a span is calculated by a field expedient formula used by the North Vietnamese Army, $C=30Kdr^2$. C is explosive required. K is a factor for specific resistance characteristics of construction of the span—wood, concrete or steel. D represents thickness of the bridge, or breaching distance in meters. R is the distance from the center of the explosive mass to the top of the bridge.

Kilograms of explosive required by the formula is based on deterioration of the strength of the blast taking place when it passes above the surface of the water. Since submersion of the explosive reduces the quantity needed to drop a span, that quantity may be reduced (by up to one-half) by scheduling detonation at high tide, when the water level is closest to the bridge span. (At a depth equal to or less than ½ r, the charge may be reduced by as much as one-half. Tests indicate this formula has some validity.)

Early in 1969 the 20th Engineer Brigade began a survey of bridge security in the III Corps Combat Tactical Zone. Key bridges in this region were visited by a team accompanied by a Hoi Chanh who had been trained in bridge demolition by North Vietnamese forces. Each bridge was analyzed to find weaknesses in existing protective systems. The object was to find ways to eliminate weaknesses that made bridges susceptible to sapper techniques. The bridges had six common weaknesses.

- River inlets within 100 meters of bridges seldom yielded to good observation.
- Mine booms (cables stretched across a river's upstream side, at water level) which did NOT have chain link or concertina wire fencing suspended below water level, would stop floating mines but would not deny swimmers access to bridge piers.
- Sampans capable of transporting large quantities of explosives were generally allowed to pass unchecked under bridges.
- Due to improper placement, lights did not eliminate shadows and dark areas on the water surface.
- Catwalks, suspended beneath the superstructure on piers, were often too far above the water to allow effective observation.
- Guards unconsciously established habit patterns on their watches. An observant enemy could pick the best time for an effective attack. This weakness, present at the site of the Phu Cuong Bridge, was capitalized on by Lieutenant Diem's sapper team.

As a result of experiences in Vietnam, U.S. Army engineers have developed improved bridge defenses. A mine boom strung across the river can help keep the enemy away from a bridge structure, if chain link and concertina wire is suspended deep into the water from the boom. Such an obstacle is difficult for a swimmer (with no underwater breathing device) to breech, especially if he is towing explosives. This defensive network should be supplemented by guards, posted to allow complete observation of the mine boom. After passing under such a barrier, a swimmer must surface to clear his breathing tube. At this time, he would likely be spotted by alert guards.

Barriers around piers also can be an important defensive measure. The fixed pier-protection system was designed to protect piers of permanent bridges. Steel H-piles driven into the riverbed provide a frame for rebars welded into a six-by-six-inch mesh cage, or a frame for a (less desirable) chainlink cage including the pier. The cages are then filled with "Shariffs" (three U-shaped pickets centrally welded together to form a six-pointed frame which is wrapped with barbed wire), concertina or other wire to make penetration of the cages difficult for a sapper. A critical part of this system, the catwalk around the top of the cage, allows a guard visual access to the water surface on all four sides of each pier.

Although a fixed system is a positive deterrent to attack, it has several disadvantages. 1) A tremendous port construction effort is required for each pier—in water from 20 to 70 feet deep. 2) Bridges remain substantially unprotected for a period of time since work progresses slowly. 3) Costs are enormous. It would have cost about $630,000 to place fixed protective systems on piers of the Phu Cuong Bridge, a bridge whose total construction cost was just twice that amount—$1,250,000. 4) Furthermore, abnormal tidal fluctuations on major rivers coupled with fixed-level catwalks limit a sentinel's ability to closely observe the water surface for signs of underwater activity—like air bubbles breaking the surface.

Such elaborate defensive systems clearly require great engineer effort to construct. However, as the Phu Cuong incident showed, when a bridge is suddenly destroyed by enemy sappers, the psychological impact on defending troops can be heavy.

An alternative to the fixed pier-protective system is the floating collar. Initially collars were made of wooden rafts, with styrofoam-filled containers adding buoyancy. From the sides of these floating collars, chain link fabric is dropped to the river bottom. The chain link fabric is woven together by divers to yield a closed cage, which is filled with materials in the same way as the fixed system. Time proved styrofoam undesirable for adding buoyancy because highly-organic river pollution tended to dissolve it. Also, the supply was limited. Styrofoam was replaced by Navy mine buoys ("ping-pong" balls) capable of supporting weight in excess of 5,000 pounds.

The simple rectangular frame of this wooden collar was replaced with 10-inch channel iron, cut and welded into a reinforced frame, supported by "ping-pong" balls and topped by a catwalk. Concertina wire both inside the cage and surrounding the collar discouraged enemy thoughts of climbing onto the collar platform to assault guards.

Among advantages of floating pier protection is the reduced construction effort. A platoon can complete a floating system in about two weeks, meaning that more bridges could receive defenses in a given amount of time than would be possible with fixed systems. Cost of construction also is proportionately reduced. The floating collar can be penetrated with less effort than a fixed rebar cage, but it is an effective hindrance to underwater sappers and protects piers from mines floated downstream. Floating construction can absorb considerably more shock than fixed systems, and is less easily damaged by floating debris. Repairs are more easily accomplished than on a fixed-cage. Finally, the collar deck forms an excellent catwalk for guards which by it is always at water-level.

River traffic presents a hazard to both fixed and floating pier-protection systems. Heavy currents and unskilled pilots cause boats or barges to strike the pierguards. Damage from such mishaps can be limited by effective fenders. Best fenders to date are built of nine heavy steel I-piles, driven in a pattern so that the center pile acts as an axis of rotation when a craft collides with the bumpers. Five horizontal bumpers ordinarily are used to make the fender effective at any tide level. To avoid the destructive force of a direct impact, fenders are constructed to establish channels at a 45-degree angle to the shipping stream. While fenders protect a system against river traffic, they add little resistance to an underwater sapper.

With either a fixed or floating pier-defense system, it is essential that guardposts be established at probable entry points on upstream riverbanks.

These defensive techniques all help limit access to a bridge for underwater aggressors. The key to a secure bridge, of course, is always the effectiveness of its guards. ⊖

Captain Robert J. Oldmixon is a former platoon leader with the 41st Engineer Port Construction Company in the Republic of South Vietnam. Currently assigned as Chief, Services Division, Directorate of Industrial Operations, Fort Belvoir, Virginia, he holds a Bachelor of Science degree from Michigan Technological University.

CIVIC ACTION U. S. STYLE

The cry for help came from a small agricultural town nestled in the heart of Colorado's San Luis Valley. The request was triggered by residents of Center, Colorado, who banded together last June to ask the U. S. Army for an assist in combating an enemy as deadly as one armed with the latest weapons.

That enemy—poverty, disease, and ignorance—is hard to beat. But the U. S. Army has faced adversity before and has always been equal to the challenge.

After a quick study of the situation by a group of officers from nearby Fort Carson, it was determined that Center had one of the lowest per capita incomes in the Nation and that problems existed between the two largest ethnic groups of residents—the "Chicanos" and the "Anglos."

To fight these imposing problems, the group recommended that a city planning commission composed of "Chicanos and Anglos" be formed to determine specific needs, set priorities for projects, and to establish the extent of community participation in the projects.

Then the Army brought in some domestic action experts—members of Fort Carson's 52nd Engineer Battalion (Construction)—to work on the four major projects. The projects consisted of a city cleanup campaign, city park improvement, preparation of city streets for paving, and closure of the city dump. All of the clean-up workload was coordinated through a central office occupied by military and civilian operating personnel.

It was a community relations publicity chairman's dream come true to see Army engineer dump trucks, front loaders, wreckers and civilian pickups and trucks

removing old car bodies from streets and yards and hauling them, along with other accumulations of junk, away to a new city sanitary fill.

Army engineers and local civilians also prepared more than five miles of city streets for paving, rehabilitated the city jail and improved the Healthstart mobile clinic.

Secretary of the Army Robert F. Froehlke liked what he saw at Center during a visit to Fort Carson and indicated that the Army's domestic action program could see increased emphasis in the future.

Mr. Froehlke said, "As long as we limit it to something that will help the soldier in his training mission; as long as we can accomplish our other goals without adding more men or dollars, I see no limitation. I don't see people objecting because we don't take over the leadership. As we get closer to that time when domestic action programs become all-important in winning-over uncommitted peoples , domestic action has to become more and more important."

With support coming from the Secretary of the Army, it is expected that the Army engineer will become more and more involved in domestic action projects like the one that was so successful at Center in the months just ahead as the U. S. Army moves into a peacetime status.

How well this type of program will be adopted by engineer troops is, perhaps, best summed up by the 52nd Engineers' commander, Lieutenant Colonel Edgar J. Mixan, who said, "Projects of this nature tend to enhance community relations, raise morale of our troops, and provide excellent training."

The photos on these pages show civic action at its best. Members of Fort Carson's 52nd Engineer Battalion got right to the heart of the matter at Center, Colorado. They worked side by side with the civilian populace to clean up the town. In the photo on the opposite page an abandoned auto is being delivered to the city dump. The three photos on this page tell some more of the story. Beginning at top left and continuing clockwise—a dozer operator takes a break with children at the city dump; a grader operator explains Army equipment to the local children; and another operator participates in cleanup operations following the demolition of a building.

ACCENT ON QUALITY

THE FACT that the U.S. Army currently is directing increased effort toward achieving its goal of being an all volunteer outfit does not imply that anything short of a highly professional, quality Army will be acceptable.

There may be some confusion among engineer enlisted personnel since new policies are inconsistent. Why, for example, is the Army seeking higher enlistment rates while, at the same time, it is involuntarily releasing other personnel?

The answer, of course, lies in the need to place decreased reliance on the draft as the primary source for the recruitment of younger soldiers while concurrently attempting to phase the overall Army strength down to lower authorized levels.

The Qualitative Management Program which was announced in Change 41, AR 600-200, is a major feature of the new program. The first phase of this program extended to June 30, 1971 and the second began July 1, 1971. The total impact of this program will have a far-reaching effect on the enlisted force of the Army.

With career tenure governed by a combination of time-in-grade and time-in-service while qualitative screening of the enlisted force continues, personnel with a history of mediocre performance will no longer be retained in the Army.

Complement this information with the recent announcements raising promotion and reenlistment criteria and one soon gets the message that professionalism and discipline would not be compromised. All of these new policies point to the fact that the "automatic reenlistment environment" is a thing of the past.

Since, under the new programs, an individual must establish and maintain his military and technical performance and qualifications at a level which will insure his tenure as a career soldier, the logical question uppermost in the minds of most career soldiers is "How am I rated among my contemporaries and how can I stay on top?"

The answer to the first part of the question lies partly with the Enlisted Evaluation System set forth in Chapter 5 of AR 600-200 and the Enlisted Efficiency Report and Rating System set forth in Chapter 8, of the same regulation.

The EM Evaluation System provides an objective measure of the technical knowledge of an individual in his Military Occupational Specialty Code while the Efficiency Report and Rating System is a subjective evaluation by the individual's supervisor of his job performance and potential. Both systems are given appropriate weight and together serve to determine if minimum qualifications have been met. The two systems also rank the individual among his contemporaries by grade and MOS. Placing consistently low can hurt an individual's opportunity to compete for promotion, reenlistment, and other career opportunities.

Commanders, personnel managers, and enlisted personnel also should be aware of another important point. In order for an individual to be in the best possible position to compete in this highly competitive environment he must be placed, within Army requirements, in a career field and MOS best suited to his prior experience, aptitudes, and potential. He must then be allowed to develop this potential to the maximum. Only then do both the Army and the individual benefit.

Now more than ever before, commanders and personnel managers must assess the potential impact on the careers of their personnel prior to any reclassification action between career fields or MOS.

Misutilization of personnel, whether through malassignment or mismanagement, may seriously jeopardize an enlisted man's career in that personnel not actively engaged in the application of their primary skills tend to lose them. This places these individuals at a disadvantage with their contemporaries during annual MOS testing. Some EM may even fail to achieve the minimum score necessary to verify in their PMOS.

Failure of an individual to verify twice consecutively in his MOS triggers mandatory reclassification action. Three consecutive failures to verify in an MOS, of course, can result in elimination from the service. These rules are set forth in Chapter 2, AR 600-200.

A low MOS score can have a tremendous impact on the individual soldier in many other areas—

- A score below 70 in the final 12 months of service bars reenlistment. (To reenlist a soldier must have been tested in the preceding 12 months unless specifically exempted by Headquarters, Department of the Army.)
- A score below 100 is a bar to promotion qualification.
- A score below 70 is a bar to the award of Specialty Pay.
- A score below 130 (Combat Support MOS) or below 120 (Combat MOS) is a bar to the award of Superior Performance Pay.

Since MOS evaluations have such impact on soldiers careers, it is the responsibility of commanders and personnel managers to ensure that EM are tested and given an Enlisted Efficiency Report during the prescribed time-frame.

Individuals should review those areas in which deficiencies were apparent in the last evaluation. The old test guide can be used in early study until the new publication is received. Care should be taken to insure that new current references are substituted.

Major General Robert R. Ploger, Commanding General of the U. S. Army Engineer Center and Fort Belvoir, and Commandant of the U. S. Army Engineer School, is encouraging all Engineer unit commanders through individual letters to exercise their responsibilities to assist personnel in improving technical proficiency.

Group seminars are ideal for refresher training when a number of individuals have the same MOS. Concurrently unit proficiency is increased.

Potential individual enrollees should complete DA Form 145, Army Correspondence Course Enrollment Application. For study groups, the unit commanders should transmit applications (DA Form 145) with the name and rank/grade of the designated group leader.

Enrollment for individual and group study can be accomplished by writing to—Commandant, U. S. Army Engineer School, Attn: DNRI, Fort Belvoir, Virginia 22060. MOS evaluation tests are scheduled for August and November 1972.

A total of 35 MOS Evaluation Tests affecting engineer personnel will be given this August. Here they are by MOS and title, respectively—12A10, Pioneer; 12B20, 12B30, 12B40, Combat Engineer; 12C20, 12C30, 12C40, Bridge Specialist; 12D20, 12D40, Powered Bridge Specialist; 12E20, 12E40, Atomic Demolition Munitions Specialist; 12F20, 12F40, Combat Engineer Track Vehicle Crewman; 12Z50, Combat Engineer Senior Sergeant; 41K20, Reproduction Equipment Repairman.

Also 51N20, 51N40, 51N50, Water Supply Specialist; 62B10, Engineer Equipment Maintenance Apprentice; 62B20, 62B30, 62B40, 62B50; Engineer Equipment Repairman; 62D20, 62D40, Asphalt Equipment Operator; 62G20, 62G-30, 62G40, Quarryman; 62H20, 62H40, Concrete Equipment Operator; 82E20, 82E30, 82E40, Topographic Computer, and 83F20, 83F40, Offset Pressman.

MOS Evaluation Tests will be given in 26 engineer specialties in November. Here they are by MOS and title, respectively—51E20, 51E40, 51E50, Camouflage Specialist; 51F20, 51F40, 51F50, Pipeline Specialist; 51M20, 51M40, Firefighter; 52B20, 52B30, Power Generation Equipment Operator/Mechanic; 52C20, Power Pack Specialist; 52D20, 52D40, Power Generation Equipment Repairman; 52E20, 52E40, Power Station Operator; 53B20, 53B40, Oxygen-Acetylene Production Specialist; 62C20, 62C30, 62C40, Engineer Missile Equipment Specialist; 62F20, 62F-30, Crane Operator; and 82D20, 82D30, 82D40, 82D50, Topographic Surveyor.

Absence of current evaluation data can also have an adverse impact on many personnel actions and will result in loss of Proficiency Pay unless testing has expressly been excused by the Department of the Army.

Today's Army is moving rapidly toward a highly qualified, competitive profession where commanders and personnel managers must apply sound personnel management principles and individuals must work hard to maintain their skills and a high level of performance.

Captain Julian E. Pylant

THE CORPS BUILDS FOR SAFEGUARD

The Corps of Engineers is managing one of the most complicated construction programs ever undertaken by this country!

On March 1969, President Nixon announced the following objectives for SAFEGUARD.

". . . Protection of our land-based retaliatory force against a direct attack by the Soviet Union.

". . . Defense of the American people against the kind of nuclear attack which the People's Republic of China is likely to be able to mount from any source.

". . . Provide for local defense of selected MINUTEMAN missile sites and an area defense designed to protect our bomber bases and our command and control authorities.

". . . By approving this system, it is possible to reduce U. S. fatalities to the minimal level in the event of a Chinese nuclear attack in the 1970's, or in an accidental attack from any source."

Thus, rather than focusing on a single purpose, SAFEGUARD has been and continues to be designed to achieve several objectives against a combination of Soviet and Chinese threats.

Extensive progress has been made in the two years since construction was started on the nation's first SAFEGUARD Ballistic Missile Defense System site. The huge concrete and steel structures at the Grand Forks SAFEGUARD complex now dominate the surrounding North Dakota wheatlands.

The second site presently authorized for deployment is in early stages of construction near Malmstrom Air Force Base in Montana. Two additional sites in Missouri and in Wyoming are currently authorized for advanced preparation which includes site survey, selection, and advanced acquisitions.

Comprised of five principal components, the North Dakota and Montana sites will consist of two types of radars, two types of missiles, and the complex data proccessing equipment that is necessary for operation and control of the SAFEGUARD program.

In operation, the system's long-range Perimeter Acquisition Radar (PAR) will detect targets as they appear above the horizon. It will track and relay target information to the Missile Site Radar (MSR) which picks up the targets in the later phases of their trajectories. The MSR will refine tracking data, calculate intercept points, and launch and control the defensive Spartan and Sprint missiles.

Normally, the long-range Spartan missile, capable of intercepts well outside the atmosphere, would be employed first. If the Spartan defense is penetrated, or if the targets are allowed to enter the atmosphere to distinguish between warheads and decoys, the short-range high acceleration Sprint missile would be employed.

The data processing equipment which integrates the other components and actually makes employment possible is capable of handling millions of calculations per second. All these tactical components are housed in hardened facilities designed to withstand the shock, dust, debris, pressure and electromagnetic pulse caused by a nuclear detonation.

SAFEGUARD development and deployment is the responsibility of the System Manager, Lieutenant General Walter P. Leber. He is responsible directly to the Chief of Staff of the Army, General William C. Westmoreland.

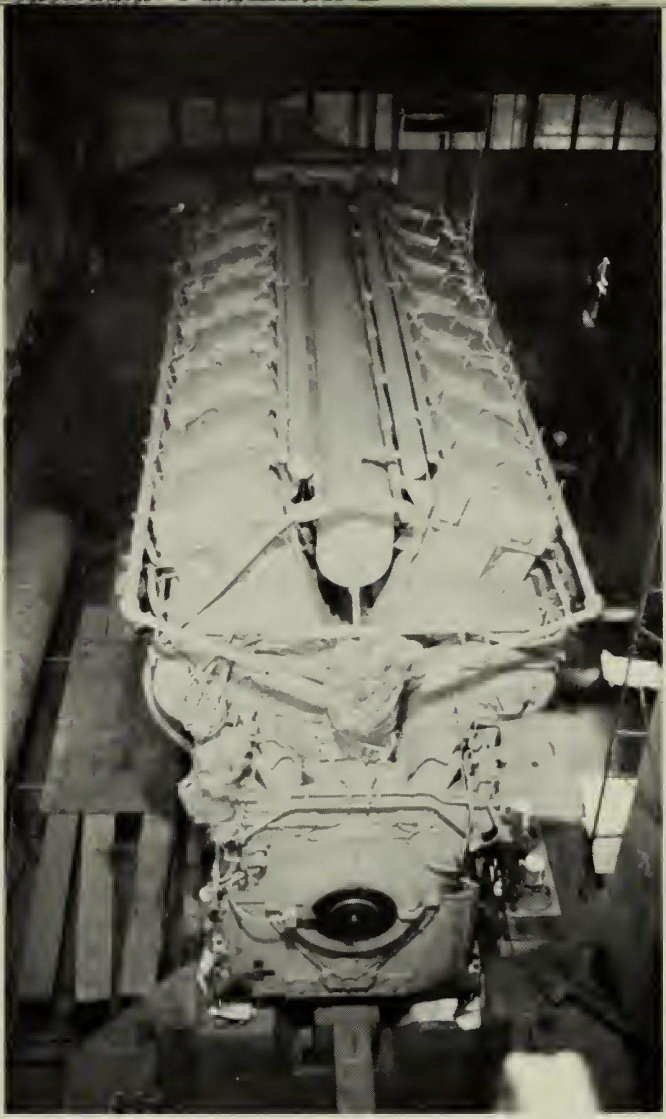
The Army's Chief of Engineers, Lieutenant General Frederick J. Clarke, has the responsibility of designing and constructing the SAFEGUARD facilities. To accomplish this mission, the Huntsville Division in Alabama was formed on October 15, 1967. The Huntsville Division, while assigned to the Chief of Engineers, carries out its functions under the operational control of the SAFEGUARD System Manager. Unlike conventional Engineer Divisions, the Huntsville Division has neither civil works functions nor territorial boundaries ɔased on watershed basins. Its military construction nission can be carried out anywhere in the 50 states.

The Division has conventional responsibilities for lesigning and construction of facilities, and site selecion and validation. Additionally, its mission includes reponsibility for operation of facilities during the instalation and test period; assisting Army Air Defense Comnand, the ultimate user in on-site training; providing ngineering support to the Weapon System Contractor t the deployment sites; assisting in development of nanning tables and equipment lists; and developing peration and maintenance procedures.

The organization of the Division reflects the scope nd diversity of its SAFEGUARD role. There are hree Assistant Division Engineers, two of whom funcion as Contracting Officers for multimillion dollar prorams. One serves as Contracting Officer for the Contruction Program, the other as Contracting Officer for Architect-Engineer services. In addition, the Chief of he Procurement and Supply Division is the Contracting Officer for the tremendous amount of governmenturnished equipment incorporated into each site. The Division's Area Offices, located at the respective deployment sites, manage the actual construction.

In creating the Division, care was taken not to staff for functions which could be performed by existing Divisions and Districts in whose area SAFEGUARD work might be located. Examples of such functions include acquisition of real estate and contracting for family housing. While the Huntsville Division performs a major role in site selection, actual land acquisition is conventionally carried out by the Office of the Chief of Engineers through respective Districts. Family housing s acquired in a similar manner.

Work at Grand Forks started April 3, 1970, three days after the award of the $137,858,850 contract. The fixed-price contract was at that time the largest ever awarded by the Corps of Engineers (a larger contract has since been signed on February 24, 1972, for Malmstrom Phase II SAFEGUARD work valued at $160,927,932). The 500-pound bid package contained 4,100 drawings and more than 5,000 pages of specifications for the four major structures (the MSR and the PAR and their power plants) and missile field. Five other construction contracts totaling more than $28 million have since been awarded at Grand Forks for the remote Sprint launch sites, nontechnical support facilities, water line construction, and family housing site work. Since construction started, the Huntsville Division has issued over 100,000 contract drawings with changes, construction shop drawings, and government-furnished equipment shop drawings.



It takes a 100-ton diesel engine like this one in above photo to drive the 3,000 kilowatt generators that provide the precise power at both the MSR and PAR sites. Left photo shows the North Dakota MSR site as it appeared in May 1971.

Work on the North Dakota technical facilities was scheduled so that each radar and its associated power plant was enclosed prior to the onset of the first winter. This was of such importance in meeting the ultimate Bid Opening Date that an item for rapid mobilization was part of the bid schedule. With closure and other winterization measures such as temporary shelters and heating, effective work on mechanical and electrical systems proceeded throughout a winter that frequently had temperatures that dropped to 30 degrees below zero.

As weather improved, the contractor increased his work force in the spring of 1971 and reached a manning level of more than 2,500 men at the two radar sites. By the end of October 1971, major concrete placement was completed on both radars and power plants.

At the control center for the Grand Forks complex, structural work on the MSR building is virtually complete. Now backfilled, only a 76-foot-high pyramid shaped turret, containing blockouts for the four radar faces, appears above ground. Beneath, there is a 232-foot by 232-foot two-story hardened building. Hardening includes electromagnetic shielding which is provided by integral one-eighth inch steel liner plate. Individual rooms in the MSR building are lined to protect components from both nuclear blast produced pulses and from mutual interference by system equipment. Another unique feature is the extensive utilization of shock isolation platforms for sensitive equipment. They are used where it is more economic to isolate the equipment than to design it to standards to withstand a nuclear shock environment.

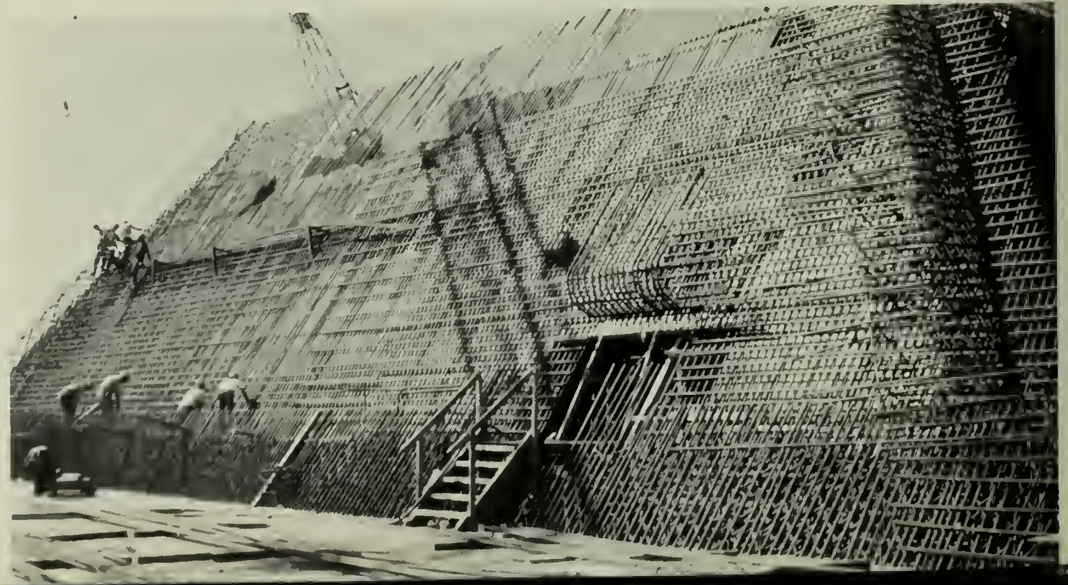
Adjacent to the MSR building is the site's hardened 17.3 megawatt power plant and an eight-million-gallon underground heat sink. Both are structurally complete and were backfilled late in 1971. Other primary tactical facilities include the Spartan and Sprint missile fields, warhead handling building, and missile assembly building. Conventional administrative, industrial, and recreational buildings and family housing comprise the balance of the construction at the MSR site.

The PAR site and its self-contained community are located some 20 miles to the east of the MSR. When structural concrete was completed on October 27, 1971, the 125-foot-high PAR became the tallest building in North Dakota. Measuring 204 feet by 213 feet at the base, it rests on a 10-foot-thick slab and has eight-foot-thick walls—all of heavily reinforced concrete. The north wall slopes back at 25 degrees and contains 6,888 penetrations for the phased array radar elements. As in the MSR, protection from electromagnetic radiation is provided by steel liner plate. The protection scheme is different, however, in that the inside of the exterior walls, floor, and roof are lined instead of lining individual rooms. As in all the tactical facilities, shock isolation platforms are used where necessary. The buried PAR power plant has a 14.4 megawatt capacity.

Four Remote Sprint Launch (RSL) sites are spaced several miles from the CSR in the surrounding Minuteman field. These are being constructed under two contracts totaling approximately $14.5 million. Though much smaller than the two radar facilities, the RSLs are of the same hardened type structures.

In all the SAFEGUARD facilities, standardization of equipment is a key factor. Over $30 million in government-furnished equipment is being integrated into the Grand Forks complex. Types of equipment include such items as 3,000 kilowatt motor generator units, pumps, chillers, electrical switchgear, shock isolators, valves, and the heavy steel cans which house the Sprint missiles. Approximately 10,000 items of 1,700 different makes and models are provided by over 50 supply contracts. At the first two deployment sites alone, standardization is expected to yield savings exceeding $32-million in reduced training requirements, maintenance, and repair parts stockage.

Captain Julian E. Pylant has been the Assistant Executive Officer of the Huntsville Division since April 1971. He is a 1965 graduate of the U. S. Military Academy, completed the Engineer Officers Advanced Course in 1968 and holds a Master's Degree in Civil Engineering from Stanford University. Previous assignments include two tours in Vietnam—one with the 169th Engineer Battalion (Construction) and one with the 326th Engineer Battalion (Airmobile).



This is a July 1971 view of the four-foot-thick turret of the North Dakota Missile Site Control Building. The workers are starting to tie resteel. The resteel used at each SAFEGUARD site totals more than 25,000 tons. This means that on an average there is almost 300 pounds of resteel per cubic yard for the some 170,000 cubic yards of concrete at each site.

THE CORPS CARES

The following excerpts were taken from U. S. Army Chief of Engineers, Lieutenant General F. J. Clarke's, address during the 105th annual Engineer dinner, May 5, 1972.

". . . . Each of us knows that 'The Corps Cares' about many things, has always cared, and will continue to care. There are some considerations, however, that I would like to reflect on for a few minutes, about the things we do care about, and some things about which we do not have concern.

". . . . The Corps has always been an action agency, and has made its reputation by doing things. It has lived by its motto—Essayons—which we translate alternately as "we try" and "we do". We live by accomplishments, and for 197 years have demonstrated time and time again that we can produce.

". . . . The work of the engineer continues to be the same basic job—of taking what nature provides, and our knowledge of the laws of nature which increases but rarely changes and applying our skills to the benefit of people, in the Army or in the country at large. And our job becomes a twofold job in the future—first of increasing our knowledge of the laws of nature, so that we can be more confident of our abilities, and secondly, of determining better what our users want, so that we can apply ourselves to what is important.

". . . . The first of the two tasks can best be described by the term of professionalism. General Westmoreland has set goals for the Army of becoming an army of professionals—soldiers who know their business and know how to practice it. We in the Corps have the identical responsibility of being professional soldier engineers. This is a responsibility which extends from the engineer soldier or specialist to the highest officers. It requires each of us to know what we should do, why we should do it, how we should do it, and to have developed proficiency in practice, so that we have confidence in our ability to do it.

". . . . This is one of our principal cares—that the Corps continue to be a professional outfit—throughout. The requirements of the Army for Engineer support go up exponentially as the Army gains new levels of mobility, and particularly as the Army sets its sights for increased mobility in the future, as the Army sets new standards of sophistication in its weaponry, and makes use of the new marvels of communication. The Army is talking about and planning on an Army that will move, shoot, and communicate better—and the job of the Engineers is to make it possible—while using the same media of water, earth (or in combination as mud) and air.

". . . . Engineer support of the Modern Volunteer Army is giving us some additional opportunities to employ troops on meaningful projects. With encouragement from General Haines at CONARC, and careful selection of stations where the limited number of engineer troops are stationed, we find them well employed on projects to improve the livability of the old barracks, on construction of ranges and rugged training facilities, in support of the tests of new techniques at Fort Hood.

". . . . The second task that I set for the engineer is to determine better what the Army needs and wants. If these needs and wants are not foreseen, planned for, and provided for, we stand a better than even chance that opportunities will be lost or delayed to our detriment. The determination of what is needed comes through many channels—but the primary one is a mutual exchange of ideas at all levels between the Engineer and the forces he supports, so that concepts are clearly understood as plans are formulated.

". . . . I see for the future that as long as we care for, and consider important, those matters which are important to the Army and the Nation, so long as we develop the professionalism of our people, and so long as we continue to act objectively and honestly, we need have no concern that the need for our services will diminish. So long as the Corps cares about others, they will care for us. ⊖

DYNAMIC

TIPS FROM THE FIELD

Lieutenant Colonel Robert L. Crosby
Secretary, USAES

In the Winter Issue of **the engineer** we announced the introduction of a new department on Dynamic Training as a regular feature. This is it. In this and succeeding issues we will present Dynamic Training ideas which have been submitted by our readers. We also will keep you informed about the activities of the Engineer Dynamic Training Council that has been established here at the Engineer School at Fort Belvoir, Virginia. In large measure, however, we are depending on you (our readers) to send your experiences and ideas to this department if it is to be successful as a primary source of Dynamic Training ideas. With perhaps a bit of innovative thinking and a dash of ingenuity, these ideas should help make your respective training programs more interesting and motivating.

In case Dynamc Training is a new term to you, maybe you will want to take a look at "DYNAMIC TRAINING, A New Approach to an Old Problem," an article that was published in the Winter Issue of this magazine. Basically, the idea is to inject new life into unit training—to do away with the monotony and boredom that is brought about by mechanically conducting training to comply with relatively rigid requirements that are established by various higher headquarters.

Army Chief of Staff General William C. Westmoreland provided the opportunity for a more dynamic approach to unit training in a message to the field in June 1971 in which he gave full responsibility for unit training to the battalion and separate company commanders of the Army. Who, after all, is in a better position to know what kind of training a unit needs? In developing a training program, who is better qualified to consider the basic mission of the unit, the contingency plans it may have to support, the readiness of that unit's equipment, the local climate, range and training facilities limitations and all of the other factors which directly affect the training program?

Perhaps more to the point, who is directly responsible for the success or failure of that unit to perform any assigned mission when the chips are down? This is why the battalion and separate company commanders have been given the opportunity and the responsibility to take a more flexible—and dynamic—approach to training.

So, it was a combination of things that led to the establishment of the Dynamic Training Board at Fort Benning, Georgia, and the Engineer Dynamic Training Council at Fort Belvoir, to help provide useful information and ideas for those individuals who are responsible for this new approach to training. The role of **the engineer** and this new department is to give visibility to these ideas.

"So, what else is new?" could be the reaction of many when they are exposed to the ideas individuals in the field submitted in response to the Engineer Dynamic Training Survey Questionnaire. It should be no surprise to anyone that new and unique ideas are few and far between. Obviously, this is as true of engineer unit training as it is of all other areas of human experience. What is important to us, though, is how we can take a successful training experience and, by injecting some of that engineer ingenuity and innovative thought, come up with a new application to fit another situation.

Here is an example of a dynamic approach to unit rifle qualification. This is not a "new problem" to the Army and the successful solution is not a "new" one in the sense that it was done within the last few months. But it was new to Lieutenant Bruce C. Clarke when he was assigned to Company C of the 3rd Engineers in 1932, and, without doubt, there are many engineer lieutenants today who are facing similar "new" situations. The first in the series of Dynamic Training experiences is submitted by that lieutenant of the "old Army," who climbed to the top of the ladder during that 40 year span of time. General Bruce C. Clarke (USA-Ret)

TRAINING

makes a point on how to motivate soldiers and tells it like this—

"The officer who can come up with a program of awards or other means of motivating his men which is effective is well on the way to being what is now called a Dynamic Trainer.

"In 1932, I was assigned as a lieutenant to Company C, 3rd Engineers, under a captain who had been a company commander for several years. The annual qualification rifle range season was approaching.

"The Company Commander put the instruction for the range season under me with the admonition that he wanted the company to win the Regimental Commander's Trophy which was given to the company with the highest average score on Record Day each year.

"I carried out what I felt was good preliminary rifle marksmanship instruction and we had good practice firing on the range.

"Before the record firing, I consulted with the First Sergeant as to what awards were given last year for record firing. He told me that about $85 was taken out of the Company Fund and prize money was awarded for the following rifle qualification positions: high offhand score at 200 yards; high kneeling score at 300 yards; high sitting score at 300 yards; high total rapid fire score at 200, 300 and 500 yards; high 500 yards score at slow fire, and high 600 yards score at slow fire. The top award was given for the high aggregate score (officers did not compete as they were motivated in other ways).

"I asked the First Sergeant who won the high aggregate the year before and he said he did.

"I wondered how such a system motivated the 'Bolos.' We had had several last year and this brought our average down. I asked for last year's record score cards.

"After much research, and being mindful of the fact that the Company Commander allowed me $85 from the Company Fund in prizes for the current year, I came up with this program which I carefully explained to the men—On Record Day you will receive five cents for each bull's eye you fire. But 4s are par—no prize. It will cost you five cents for 3s; ten cents for 2s, and twenty-five cents for misses.

"The men were skeptical. They felt that it was a device to make money for the Company Fund. I assured them that it would have cost the Company Fund about $80 last year. They reluctantly went along with my program.

"On Record Day the men won $125 from the Company Fund. Only a few had to pay in any money—none over $1.50. We won the Regimental Commander's Trophy with points to spare.

"What produced these results? Each man was competing against the Company Fund in a way that meant something to him. He tried to "hold and squeeze" each shot—even after he had enough points for sharpshooter or marksman and could not reach the next higher qualification.

"The First Sergeant was still the high winner because he was an experienced competitive shot but the men were not competing with him. His known ability did not dampen the motivation of the troops. Of course, my Company Commander was pleased. The Division Inspector General heard about it and came around to see if such a program was according to the Regulations governing the use of the Company Fund. He gave it a clean bill of health.

"We can draw several lessons in motivating men from this example (five cents was money to a soldier in 1932)."

General Clarke's method of motivating his men would be just as good today as it was those many years ago. His unit also must have participated in some form of Adventure Training in those days without knowing it by that name. Here is an example—1972 style.

Platoon Sergeant Vernon L. Allen of the 814th Engineer Float Bridge Company, 559th Engineer Battalion, Hanau, Germany, submitted the following description of a platoon-level Adventure Training experience that was conducted by his unit—

"My platoon was selected by higher headquarters to run a course setup in Adventure Training. We were to test how much weight a man could carry travelling in hilly terrain with the use of maps and compass. This included water, food, clothing for three days, ammunition, protective mask, and the weapon.

"The course started first with a helicopter ride to the drop point. Then, from the drop point we had to walk 30 kilometers in hilly terrain to a location on the main river. Between these two locations we were told to reconnoiter three demolition targets and to suggest types of targets, tools, and equipment that would be needed to do the job.

"At the river, we boarded 15-man assault boats that were provided by our company for a run down the river for 29 kilometers. The allotted time was from 8 a.m., Thursday until 5 p.m., Saturday. The platoon arrived at our home station at 6 p.m., Friday; 23 hours ahead of schedule. The test was a success and the course is now being used by the units of the 130th Engineer Brigade."

There is much more to the Dynamic Training program than just Adventure Training. Dynamic Training embraces the entire unit training picture. For example, Captain Thomas F. Ramos submitted this description of some squad-level training that was conducted while he was with the 237th Engineer Battalion, Heilbronn, Germany—

"To increase the confidence and proficiency of my squad leaders, and to help them get to know their men better, I sent my squads on three-day missions. A squad was subject to be called on to move out on these missions at any time without previous warning.

"If a squad leader was alerted after duty hours, he had two hours to round up his squad and leave the kaserne (post) in his vehicle with all equipment aboard. Missions included preparation and execution of target folders, route reconnaissance, erecting rope bridges across small rivers, mine detection, and anything else that was pertinent to our squad missions.

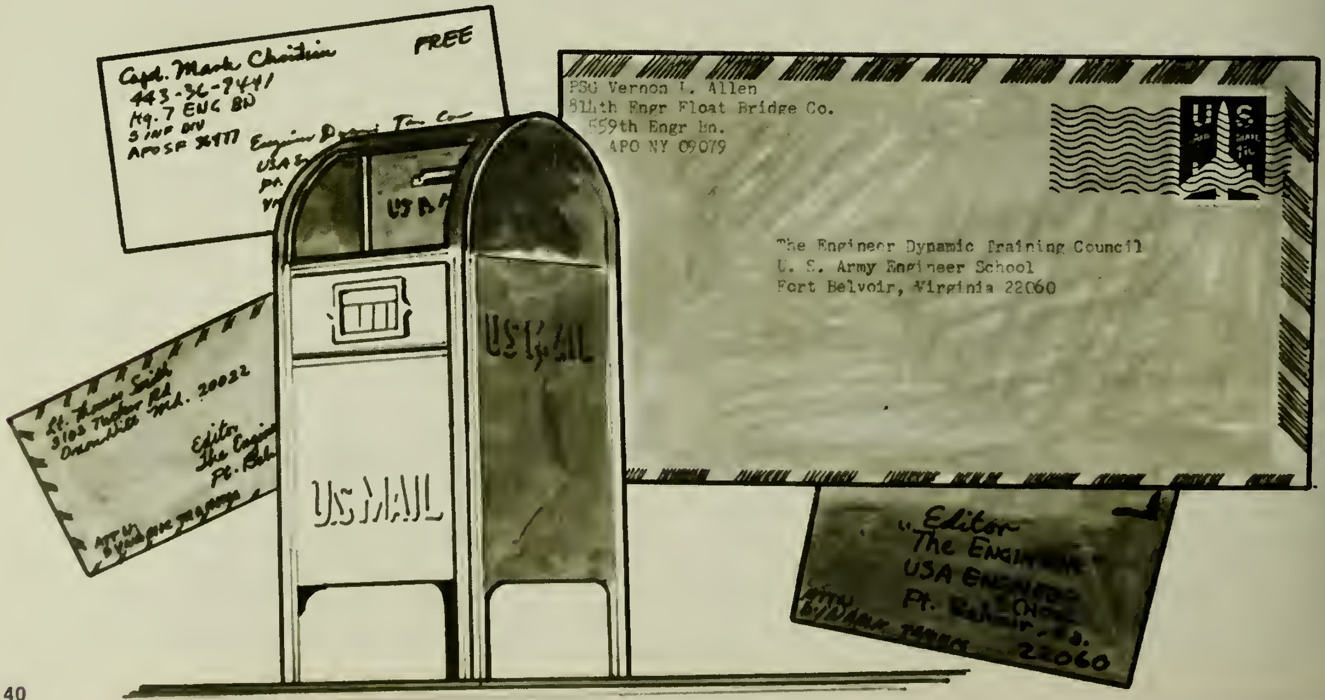
"The exercise was usually concluded with a 10 mile map reading course across wood countryside. Rations were picked up by giving the squad leader only the map coordinates as to their location on the radio.

"As the program developed, I was able to send one squad out each week on a mission. We even broadened the exercise by requesting aviation support. Competition among the squads on who performed the best missions added a great deal of enthusiasm to the program."

These are the types of ideas and experiences we are looking for from you. What you submit does not have to be "new." Sergeant Allen's experience was just as new as General Clarke's experience as a lieutenant. What is essential is that the Dynamic Training idea in some way presents some form of stimulation or challenge. The reward is that the unit, individually and collectively, realizes that it has successfully performed a task or mission—while exercising and perfecting the missions' essential skills. This is where it's at!

How about you? Have you led or been involved in any particularly interesting and effective training exercises? The Engineer Dynamic Training Council is interested in hearing about what you have done. This department of "*the engineer*" will regularly feature ideas that have been submitted. We need your support. So please send a brief write up of your training experiences and ideas to: The Engineer Dynamic Training Council, U.S. Army Engineer School, Fort Belvoir, Virginia 22060. ⅇ

Lieutenant Coloniel Robert L. Crosby currently is Secretary of The Engineer School and Deputy Chairman of the Engineer Dynamic Training Council. His assignments have included duty with the 271st and 9th Engineer Combat Battalions; Commanding Officer of the 92nd Engineer Construction Battalion, and later as IV Corps Engineer Advisor in the Republic of Vietnam. He is a graduate of the Air War College, holds a master's degree in Civil Engineering from Iowa State University, and is a registered professional engineer in the "Hawkeye" state.



Engineer OCS- Another Perspective!

CAPTAIN JOHN J. CONNOR

"Grossing Out Delta Company," a story on Engineer Officer Candidate School (OCS) by Sergeant (then Specialist 5) Hugh M. Gildea, appeared in the last issue of **the engineer,** *Winter 1972. In a response to that story Captain John J. Connor, who attended EOCS at an earlier time, presents an opposing point of view. After a year's duty as a tactical officer Captain Connor departed the Officer Candidate Regiment in May, 1969, about the time Sergeant Gildea's class began "the Program."*

Could a rookie baseball player who was cut from his team in spring training be an authority on the playing of major league baseball? How well then could a 23-week course be judged by a student who experienced only eight weeks of it?

To understand the perspective from which Specialist Gildea viewed the Engineer OCS program, I did some homework, checking official records and interviewing several people to get an appreciation for the people and events that shaped his experiences during those two months. I concluded that his analysis was based on a very limited, restricted experience. But a point-by-point rebuttal would leave much unsaid. A positive approach would try to show what OCS *was* rather than dispute what it was not.

Most of Specialist Gildea's misconceptions can be attributed to the fact that his judgments are based on the first eight weeks of the program. The junior and senior phases (which he did not experience) were far different from that underclass program, as I hope to make clear. In his nearsighted perspective, Specialist Gildea fails to see the differences between "means" and "ends." Certain elements of the program which seemed bothersome and pointless at the time had purposes which later became clear.

To judge whether the officer candidate school accomplished its mission, we must first look at that mission. Then we should examine the way it went about executing its mission with what was called "the Program." Third, we need to judge the OCS graduates.

DA Pamphlet 601-1 (*The OCS Story*) states: "The mission of Officer Candidate Schools is to develop competent leaders for the nation's Army. These schools emphasize the development of practical leadership, with special emphasis for male candidates on building physical stamina, and the mastery of tactics and weapons. The rigorous program of training and discipline furnishes the means of confirming whether a candidate possesses the potential ability to become a competent leader. The schools' further function is to develop this ability once it is recognized, by teaching the professional knowledge needed for successful leadership."

This statement informs us that OCS has a dual mission, first to confirm a candidate's potential and then to develop it.

The initial part of this mission, which included the plebe and underclass phases, took up the first one-third of the 23-week program. During these two memorable months the candidate's mettle was tested. To the plebe it was a period marked by endless missions with never enough time to complete them. In these hectic weeks he learned how to "function," that is to plan, organize and efficiently use his time, manpower and resources—a very important lesson indeed!

It was during this period that most of the candidates who would fail to complete the program were eliminated—victims of poor physical condition, lack of desire and motivation, or less frequently, lack of ability. At this point very few candidates, especially those who dropped out, realized what was really happening. It wasn't until much later in the program that "lessons learned" became clear. But toward the end of this phase there did appear to be hope for the bewildered candidates, some light at the end of the tunnel in the form of "white tabs" which signified the junior phase.

In this middle stage a class was at its peak when it began to supervise an underclass of its own. This was a unique experience for most candidates, entirely different from sharing command positions among one's own peers. This was the first taste of leadership, the first real feeling for what the program was all about. It was, however, a time to make mistakes. The candidates made many mistakes, and paid the consequences for them. . . . And a few more candidates were dropped from the program.

Then came "Operation Red Tab," the tactical exercise which led to senior status. It was now time to polish rough edges and assume greater responsibilities—company, battalion and regimental command positions. It was a time to assess one's progress through the many weeks of training.

Only now did some of the obscure events of the early weeks make sense. The "switch-around-switch" for example, which at the time seemed nothing but harassment, served several purposes. This exercise tested a class's ability to organize and work as a team, and at the same time gave everyone a better chance to get to know all those men they were helping to evaluate. From the perspective of a senior, the candidate could see that this exercise and other training tactics were only "means" designed to achieve a specific "end," development of competent platoon leaders. By learning how to "function" early in the program, senior candidates were able to routinely accomplish tasks that a few weeks earlier seemed impossible.

How many times did a senior stare in disbelief as members of a new class stumbled all over themselves attempting a simple mission and ask himself, "Did my class really look like that?" Newly developed skills, discipline, stamina and organizational abilities helped mold a candidate throughout the program to graduation, and on to his initial assignment as a second lieutenant. It becomes evident that even OCS itself was only a means designed to train a man to be a leader. It was not the OCS goal to mold a man to be a good *candidate*, as an end in itself.

One candidate's thoughts as he looked back on the program are revealed in an excerpt from a speech given the eve of his graduation in November, 1968. "Officer Candidate School *has* done something for us because it was a . . . succession of constant challenges that made us look closely at ourselves and others (and it) has given us a confidence in ourselves and the growing ability to 'keep our heads while all (those) about us are losing theirs.' The program has taught us to roll with the punches, to handle crises, to control men, to command respect—all necessary abilities of a platoon leader which we are now more qualified to be. Of course we're not perfectly qualified, no Program can profess to accomplish that mission. But at least we're the product(s) of a system designed to eliminate the totally unqualified and, more importantly, to develop the potential of the qualified. We have succeeded here and success will stay with us, promoting greater success(es) in the future. OCS has done something . . . different for each one of us, but basically it has prepared us to do a better job as platoon leaders."

Any article that attempts to convey the meaning of OCS but contains no mention of the black-capped, ever-present, never-satisfied group of men known as "tacs" would be anything but complete. Again the words of a candidate best describe the tactical officer and the role he played in OCS life. This description is taken from a presentation to Class 14-69, "These are the men who pushed us, men who drew from us the stuff necessary to make a good leader. There were times we inwardly cursed and briefly hated them (when) they did what they knew was necessary. The *why* of it is clear now. We admire them and what they have given us, and again we know pride. Pride that we have measured up to their standards, pride that we shall be treated as their equals even though they will always seem a bit taller, their expectations a little out of reach."

But their expectations *were* reached! Whether at the rocky training sites of Fort Leonard Wood, Missouri, or in the lush jungles of Vietnam, Engineer OCS graduates forged a distinguished record of accomplishment of which they can be justly proud. To their credit are literally hundreds of bridges of all descriptions, mile after mile of roads, plus countless other combat, military and civic-action construction projects that bear solid testimony to both their spirit and their skill. This prized record was won by the sweat, the blood, and in many cases the very lives of these young men.

On December 10, 1967, the Distinguished Service Cross, the nation's second highest award for valor, was posthumously awarded to Second Lieutenant Robert E. Knadle (Clearing The Way, Fall Issue, **the engineer**) for gallantry in action near Phu Li Bridge, Republic of Vietnam, where on October 9, 1967, just 10 days before his 22nd birthday, "he was mortally wounded while gallantly leading his men in the face of grave danger." A special exhibit honoring Lieutenant Knadle, December, 1966, graduate of Engineer OCS Class 2-67, is part of the OCS Hall of Fame in the Engineer Museum at Fort Belvoir, Virginia. The Hall of Fame honors all Engineer OCS graduates through recognition of achievements of its most distinguished graduates from the three eras marking the existence of Engineer OCS—World War II, Korea and Vietnam.

In all three programs the "end" was the same, but the "means" were varied. During the Vietnam era (1966-70) the program was constantly being refined. In 1968 graduates were first commissioned in branches other than the Corps of Engineers. Graduates of the "Old Program" (that was everyone before your underclass) would hardly recognize the program of late 1970 that saw underclass candidates without the traditional "beanhead" haircuts, when weekend passes were standard for all candidates after the second week. But all exterior trappings were secondary to the goal—training a competent second lieutenant.

In the early days of the Vietnam buildup, OCS depended heavily on career-type enlisted men with prior service to fill its ranks, but after mid-1968 the typical candidate was a fresh-to-the-ranks college graduate. New means were required to achieve the same goal. Occasionally a "means" lingered after its usefulness had passed, but this should not be cause for forsaking the entire system. In the final analysis it can be judged that the Engineer Officer Candidate Program successfully completed its mission.

Should a future conflict require for a fourth time that Engineer OCS be called into the service of its country, I would be proud to be a part of it again! e

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A May 1968 EOCS graduate, Captain Connor was a Tactical Officer in the Engineer Officer Candidate Regiment from June 1968 to May 1969 and again in June and July of 1970. Between OCR assignments, he served in Vietnam as a terrain intelligence officer with the Assistant Chief of Staff for Intelligence (J-2), Military Assistance Command. Since July 1970 he has been a geology instructor, Dept. of Engineering Science, US Army Engineer School, Ft. Belvoir, Va.

Bridging

LIMITED QUOTA EXISTS FOR OFFICERS TO TRAIN AS ROTARY WING AVIATORS

APPLICATIONS ARE being accepted for officers to train as rotary wing aviators, but selections are being made on a best qualified basis. A decrease in warrant officer candidate flight training created a very limited need for commissioned officers to train in this field. To be eligible, officers must have less than 48 months commissioned service at time of entry and should have an above average performance record. Interested officers should consult AR 611-110 for information or contact the Engineer Branch.

SPECIAL PROGRAMS CAN ENHANCE OFFICERS CAREERS

THE ARMY wants officers to become more aware of the opportunities special career programs afford qualified individuals. These programs are designed to develop and assign officers who are particularly well-qualified in certain functional areas. Such areas are of special Army-wide importance, but do not fall within the development pattern of a single career branch. Specialist programs have been established for careers in Atomic Energy, Automatic Data Processing, Comptroller, Foreign Area Specialty, Information, Logistics, Military Assistance, Operations Research/Systems Analysis (OR/SA), Procurement, and Research and Development. Army Regulations in the 614 series describe the prerequisites, procedures for enrollment, education and training, career development, and specific positions associated with each program. Officers should consider the possibility of developing a specialty in addition to maintaining their branch competence. Interested individuals should review the AR's and contact their assignment officers to discuss how membership in a special career program could enhance their careers. Right now the Engineer Branch is primarily interested in having new members participate in the Logistics, Military Assistance, OR/SA, and Research and Development programs.

THERE IS NO SECRET OR MAGIC OML

MANY OFFICERS think there is something secret or magic about the OML (Order of Merit List). To set the record straight an OML is a merit ranking of officers of the same branch for a limited specific purpose. OML's establish the relative standing of an individual officer among his branch contemporaries to insure equal consideration in the identification of the best qualified officers when making career management decisions. OML's are prepared for specific purposes at specific times—such as recommendations for CGSC, graduate school, and so on. Therefore, any given OML will contain only the names of those officers who are eligible for the personnel action that is being considered. All career branches in OPD use the same general procedures to prepare OML's but no attempt is made to compare officers with their contemporaries in other branches. Major factors considered in the preparation of OML's include manner of performance as indicated on the officer's efficiency report, awards and decorations, combat experience, and military and civilian education. An officer's relative standing can change from one OML to another depending upon the particular group of officers with whom he is compared and the purpose for which the comparison is made. Assignment officers can inform an individual during a normal counselling session whether he was recently considered for some opportunity and where he stood in that consideration.

the Gap

ARMY ENDEAVORS TO STABILIZE TOUR LENGTHS

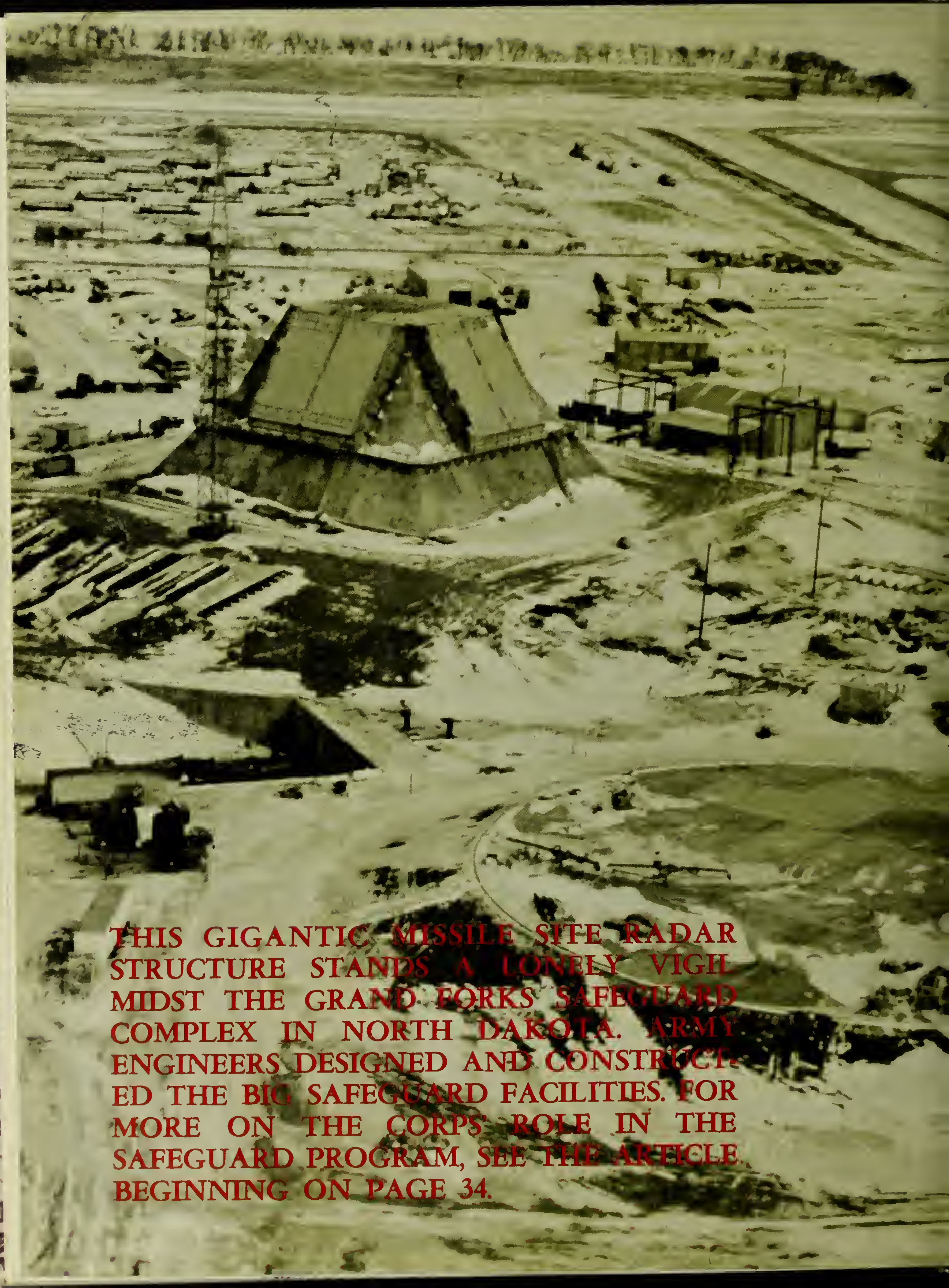
SHORT TOUR requirements have begun to drop for Engineer Officers and warrants. Greater stabilization has arrived now that the Army is cutting back its strength. Today, the Engineer Branch says that dependent tours in Europe should be three years and all Continental U. S. tours at least two years. Also tours with major commands and agencies are being stabilized to three years. It is interesting to note that only a year ago almost 25 percent of the officers in the Corps were serving in short tour areas. And as the drawdown in Vietnam continues, it is expected that many officers will not be permitted to complete their full tour there. Many will be pulled out without being able to complete five-sixths (10 months) of the tour. Even so, the Engineer Branch points out that any officer in this category will receive credit for a short tour regardless of the time he has spent in Vietnam provided the curtailment is for the convenience of the government.

CERTAIN PERSONNEL INELIGIBLE FOR ASSIGNMENT TO HOSTILE FIRE ZONES

INDIVIDUALS BEING ASSIGNED to a hostile fire zone should check their status in regard to the following additional requirements for the area. If they have not had a dental check, they should insure that dental examinations are accomplished and appropriate dental care is completed in accordance with Chapter XIII, AR 40-3. If they are under 18 years of age at the time they are scheduled to report to the oversea replacement station, they are ineligible for assignment in accordance with Paragraph 8-1, AR 614-30. If they are assigned to a country in which they were previously in a prisoner of war status, they are ineligible and should be deleted from the alert orders in accordance with Paragraph 8-1, AR 614-30. If they are credited with a tour in the Republic of Vietnam, they will not be involuntarily assigned to that country unless expressly affirmed by the Chief of Personnel Operations in accordance with AR 614-30 and AR 614-200. If they are sole surviving sons, they must sign a waiver indicating that no objection is interposed for the assignment in accordance with AR 614-75. If they have another family member in a Hostile Fire Zone, they may be eligible for a deferment. There also are other conditions involving immediate family members that may qualify them for deferment or exemption from assignment to a Hostile Fire Zone, in accordance with AR 614-30.

UPDATED ARMY FILM GIVES BETTER SLANT TO GROWING ROLE OF EES

THE FILM "EES, Key To Your Future" has been updated to more clearly portray the ever-growing role the Enlisted Evaluation System is serving under the Modern Volunteer Army concept. The film (MF12-5663) is now available at all field audiovisual centers. The importance of the Enlisted Evaluation System as a personnel management tool in the development of the soldier's career is dramatically portrayed. The film focuses attention on the responsibilities of the individual soldier, commanders, test control officers, personnel officers, and the U. S. Army Enlisted Evaluation Center toward the successful operation of the system. It explains how the system affects the individual soldier's future regarding such important personnel actions as promotions, award of proficiency pay, assignments, retention in service, and eligibility for reenlistment.



THIS GIGANTIC MISSILE SITE RADAR STRUCTURE STANDS A LONELY VIGIL MIDST THE GRAND FORKS SAFEGUARD COMPLEX IN NORTH DAKOTA. ARMY ENGINEERS DESIGNED AND CONSTRUCTED THE BIG SAFEGUARD FACILITIES. FOR MORE ON THE CORPS' ROLE IN THE SAFEGUARD PROGRAM, SEE THE ARTICLE BEGINNING ON PAGE 34.

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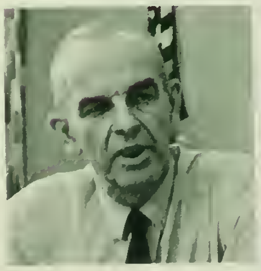

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DD

CHIEF'S BRIEFS.....

Etienne Nicholas Marie Bechet, Sieur de Rochefontaine, later known as Lieutenant Colonel Stephen Rochefontaine, lies buried in the churchyard of St. Paul's chapel of Trinity parish in New York City. This French officer, the fourth Chief Engineer of the United States Army, is probably the most distinguished of his nationality who actually took part in the military operations of the War for American Independence and who is interred on American soil.

He was born on February 20, 1755, the son of a wine merchant, on the right bank of the Marne River in a town famous for its production of sparkling wines---the town of Ay.

Little is known of his early military training, although conjecture has it that he possibly had been to the Royal Military School of Brienne-le-Chateau, transferring later to the Military School of Paris---the usual routine at that time. He was just 23 years of age when he arrived in America and volunteered for service in General George Washington's Army. On September 18, 1778 he was appointed a Captain in the Corps of Engineers, and was one of two engineers recommended for promotion during the Siege of Yorktown. On November 16, 1781 he was brevetted a Major by Congress for his distinguished service during that conflict.

In 1783 Rochefontaine returned to France and re-entered the service of King Louis XVI as a Captain in the provincial troops. The king subsequently appointed him Adjutant General of the Army of Santo Domingo. He escaped to America shortly after the king was executed, and was appointed a civilian engineer to fortify the New England coast by President Washington. When the Corps of Artillerists and Engineers were organized on February 26, 1795, Washington made Rochefontaine a Lieutenant Colonel and Commandant of the new Corps. He established a military school at West Point in 1795, but the building and all of his equipment were burned in 1796. Colonel Rochefontaine remained as Commandant of the Corps until he retired on May 7, 1798, "to enjoy in the midst of friendship an esteem justly acquired and a repose worthily merited." He lived in New York City until his death January 30, 1814.

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BG Richard L. Harris

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Editor
Robert G. McClintic

Executive Editor
CPT Dennis F. Pierman

Contributing Editor
William T. Spriegel

Art Director
John W. Savage, Jr.

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ABOUT THE COVER

Art Director John W. Savage, Jr., uses a scale model on the cover to point up the seriousness of man's battle to save his environment from the pollutants and waste that threaten the very air, water, and land on which he lives. The Corps' effort to do something about the problem is told in this issue.

Pipeline

ENGINEER OFFICERS MOBILIZED TO ASSIST AGNES FLOOD VICTIMS

In response to an emergency situation in five states resulting from the worst and most extensive flooding on record for the East coast, the President directed the Department of the Army to mobilize approximately 100 engineer officers.

More than 60 company grade officers from the Engineer Officer Advanced Course and about 20 field grade officers from the First Army area were alerted on Sunday afternoon, June 25, for departure on temporary duty to flood ravaged Pennsylvania, New York, North Carolina, Maryland, and Virginia the following morning.

According to Major General John W. Morris, Director of Civil Works for the Corps of Engineers, who briefed the alerted officers, action directed toward preventing the loss of human life was the priority mission. Disaster relief in the form of restoring lines of communication and removing debris left by Agnes comprised the mission for the remainder of the operation.

Officers who were selected for the task returned to their duties here at Fort Belvoir weeks later, after which local efforts were applied independently to restore life to its normal activity.

IMPACT STATEMENTS ON ENVIRONMENT PUBLISHED BY OCE

The Office, Chief of Engineers, has published a compilation of draft and final environmental impact statements prepared by the Corps of Engineers and filed with the Council on Environmental Quality during the first calendar quarter of 1972.

Copies of the current compilation (Vol. II, Jan.-Mar., 1972) and Volume I (1970-1971) are available upon request to: Public Affairs Office (DAEN-PA), Office of the Chief of Engineers, Washington, DC 20314.

SHORELINE EROSION COULD BECOME ALARMING PROBLEM

Current shore protection programs are not keeping pace with needs, according to a U.S. Army Corps of Engineers study of the National Shoreline.

This first study ever by the Corps of shoreline erosion has produced some startling findings.

- Erosion of about 43 percent of the 37,000 miles of U.S. shoreline outside of Alaska causes widespread loss of land and property. Life can be endangered within five years in the most threatened areas.
- Measures to halt erosion appear justified for 2,700 miles of shoreline at an estimated cost of $1.8-billion. The critically affected areas are 1,090 miles of North Atlantic coast, 1,110 miles on the South Atlantic and Gulf coasts, 220 miles of the Great Lakes, 80 miles in California, 70 miles of the North Pacific, 100 miles in Alaska, and 30 miles in Hawaii.

The report says first priority erosion control should be given to about 190 miles of shoreline where, if erosion is allowed to continue, public safety is likely to be threatened as early as 1976.

The coastal zone is growing more rapidly in population than other parts of the nation. In the past 10 years, 90 percent of the national population growth was in coastal states. The 30 coastal states have 75 percent of the nation's population and 12 of the 13 largest cities.

There are about 12,000 miles of beach frontage in the United States outside of Alaska. About one-fourth of the beach frontage has been developed for public recreation. Because many hundreds of millions of Americans visit the beaches each year, they are overcrowded and cannot satisfy foreseeable recreation demands.

This report by the Corps is the first over-all national appraisal of shore erosion problems. After three centuries of focus on the interior of the nation, attention is coming back to the coastal zone.

In his annual report to Congress on marine resources and engineering development last year, President Richard M. Nixon said, "During the past few years no single body of marine problems has attracted as much attention as those encompassed in the U.S. coastal zone."

The study points out the importance of the shoreline by underlining the fact that it is the heart of the coastal zone. This is where, according to the report, land, people, and sea meet.

NUCLEAR POWER PLANT IS SLATED FOR DEACTIVATION

The Chief of Engineers has announced that the SM-1 Nuclear Power Plant at Fort Belvoir, Virginia, will be deactivated in May of 1973.

The SM-1 became operational in April, 1957, as the first of a family of nuclear power plants developed under a joint Atomic Energy Commission-Department of Defense program. It was built to train plant operators and accomplish research and development tasks for the three services.

The Army expects to continue training for specific needs on a small scale using the existing reactor simulator and fuel handling facility at Belvoir, but in-plant operation will be conducted subsequently at the MH-1A site in the Canal Zone.

EIRs CAN SOLVE PROBLEMS WITH BAD HAND TOOLS

An Equipment Improvement Recommendation (EIR), prepared on DA Form 2407, may be the answer to problems you experience with hand tools when they don't hold up under normal use or just don't seem properly designed for the job the book says they can do.

The U.S. Army Mobility Equipment Command (MECOM), the folks who are responsible for correcting these problems, cautions that you should not be misled by the title of the form into thinking it has application to major items of equipment only. If used properly, they say, you may never have to use your self-service supply money again to replace a new tool that has disintegrated in your hand the first time out of its box.

Stock up on DA 2407's and help MECOM keep you supplied with quality hand tools. Send your completed forms directly to: Commanding General, U.S. Army Mobility Equipment Command, ATTN: AMSME-MAO, 4300 Goodfellow Blvd., St. Louis, Missouri 63120.

This soldier from Company B, 79th Engineer Battalion, Karlsruhe, Germany, is at the controls of some real heavy equipment. Normally a five-ton driver, he can't say he is working outside his Military Occupational Specialty. But where do you get Army training for a pachyderm permit? The company is felling trees and doing earthmoving work at the Saarbruecken Zoo as part of a "Helping Hand" project. Why the elephant? Guess he wanted to pitch in too. After all, this is a project to enlarge the zoo complex and everyone knows elephants need all the room they can get.

engineer interview:

with major general Willard Roper

Now, more than at any other time in its long and impressive history, the U.S. Army Corps of Engineers is directing its considerable technical talents and professional expertise toward the mounting problems posed by pollution in the environment.

One of the most important aspects of the national effort to clean up the environment is effective management of waste water.

Proper waste water management will provide a source of added water supplies through recycling, permitting re-use by industry and agriculture and many other uses.

The Corps initiated its Waste Water Management Program last year, charging its Board of Engineers for Rivers and Harbors with responsibility for the program.

To find out first-hand the extent of the program and the progress being made in waste water management, **the engineer** *interviewed Major General Willard Roper, Chairman of the Board of Engineers for Rivers and Harbors, who assumed that position in August, 1970. Prior to that, General Roper served for one year as Division Engineer of the Ohio River Division, U.S. Army Corps of Engineers, from 1966 until October, 1967, when he was assigned to Vietnam as Commanding General of the 18th Engineer Brigade and later as Commanding General, U.S. Army Construction Agency, Vietnam. He returned to the Ohio River Division in November, 1968.*

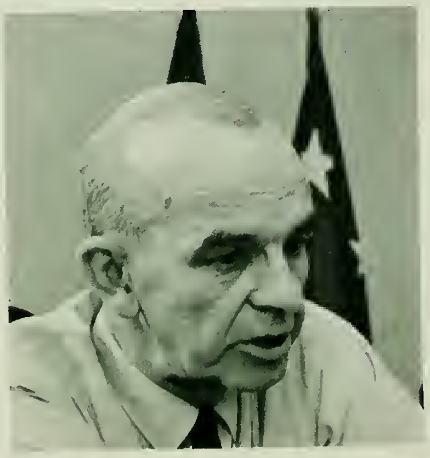
During his more than 28 years of military service, General Roper has held posts as Area Engineer on civil and military projects both here and abroad, as Engineer Staff Officer for the Chief of Engineers, as Commanding Officer of an Engineer Combat Group and with the U.S. Air Force Headquarters and SHAPE Headquarters in Paris.

General Roper is a graduate of the Massachusetts Institute of Technology, the Army Command and General Staff College, the Industrial College of the Armed Forces, and is a registered Professional Engineer in the District of Columbia.

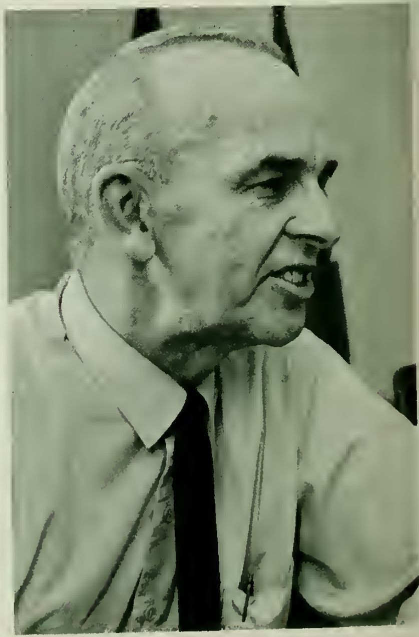
Answers to a number of probing questions follow in this exclusive interview.

engr: General Roper, as Chairman of the Board of Engineers for Rivers and Harbors, you are heading up one of the most important projects the Corps of Engineers has ever undertaken. Would you give our readers an overview of the waste water management program?

ROPER: Yes. Waste water management is a program of studies we were asked to undertake to examine the waste water problems of some of the metropolitan areas of the United States on a regional basis. We have started with five so-called pilot studies, which include the Merrimac Basin in New Hampshire and Massachusetts, the Cleveland-Akron area in Ohio, metropolitan Detroit, metropolitan Chicago and the San Francisco Bay area. As of now, we have produced feasibility studies of each. Although rather hastily done, they have demonstrated that a high level of treatment was obtainable by a number of alternative means. Since then, we have proceeded in accordance with the wishes of Congress and the administration, with detailed studies of four of these---all but the Merrimac area. In response to a specific request from the ad-



"We should design systems . . ."



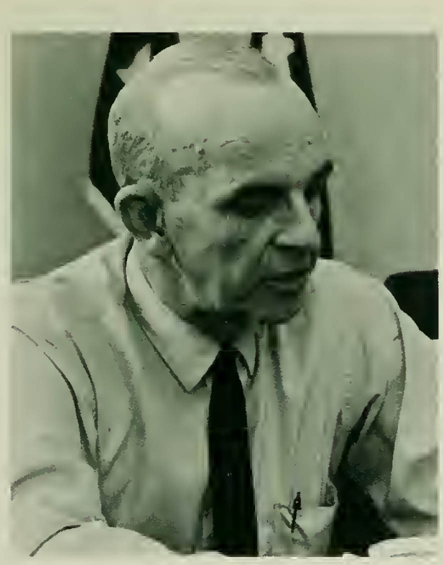
". . . to meet the needs of 1990."

ministration, we have produced a special report on the Chicago area. However, I don't want to imply that we are through with the Chicago study in saying this. We intend to finish the detailed survey reports, as we term them, by the end of 1972. These reports, in each case, should recommend a system for managing the waste water of the metropolitan area in sufficient detail to permit its authorization---presumably by certification to the Environmental Protection Agency and the allocation of matching funds under that agency's grant program.

engr: Was there any specific reason for choosing these five study areas?

ROPER: There were several factors influencing the decision. First, we wanted major metropolitan areas because we've always looked at water on a regional as opposed to a local basis. So it appeared that we could provide a regional approach to this problem. In addition, we had undertaken to do a detailed study of alternatives which would include land treatment as one. That's really how we got into the study. These considerations were certainly major factors in the initial selection of these specific areas. Secondly, these areas had major problems. And third, we had studies already underway on related problems in these areas. So we already had the necessary funds and authority to study water problems. Congress, through committee action and the administration, through Office of Management and Budget (OMB) action, authorized us to redirect the ongoing studies to look at this particular aspect.

engr: What sort of a connection do you have with the Environmental Protection Agency? Is there an inter-relationship between the Corps and EPA?



ROPER: Yes, in the conduct of the feasibility studies, we had a memorandum of agreement with the agency whereby we agreed to consult with them, work together and to accept their views on certain things. I think that it has worked out reasonably well, although the degree of coordination was less than we would have liked because we had to produce the feasibility studies in such a short period of time. We had to work them up between February and the first of August, 1971. In the conduct of the detailed studies, we are working with the Environmental Protection Agency in each of our field offices. We are also coordinating our activities with the states, which is equally important. Obviously, if we come up with a plan that is going to be carried out, it must be acceptable both to the state and to the EPA.

engr: How large a budget have you to run this program?

ROPER: We're talking in terms of study costs for a major metropolitan area in the order of $1-million. So you can figure about $5-million, roughly, for the five metropolitan areas. We will proceed with more as a result of action subsequent to the original direction. We are only referring to study activities now, so when we speak about budget, we're talking about the budget to do the studies. The budget to carry out the actual work is something else again.

engr: How does the Federal money fit into the state plan?

ROPER: Well, let me touch on the five pilot studies. These are financed for planning by appropriations to the Corps of Engineers, and the outcome of the studies should be a report which will serve primarily two purposes. First, it will be a report which the state can use in seeking design and construction financing through normal channels---certification to the Environmental Protection Agency, and the receipt of a Federal grant under existing law. Secondly, it will constitute a report to Congress on what we have done ---what plan we generated and recommended to the state. It will indicate also, as best we know it at the time, what the state intends to do with it.

engr: Has your assistance been requested by local communities?

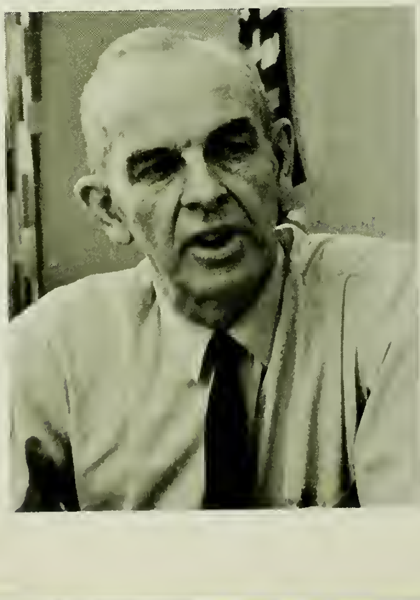
ROPER: Well, in the original five, there was no initiative on the part of the localities to ask for assistance. The initiative, I think, really came from Washington---Congress and the OMB. Obviously, if the Congress asked us to do this, it reflected some interest on the part of local areas. However, on the subsequent studies and on the continuation of these studies, we have had resolutions in each case from the Public Works Committees of both houses of Congress which were initiated through the Congressional delegate and therefore reflect the desires of the local people or state interest.

engr: What type of treatment process will be used in these areas? Are you leaning toward the chemical process, or land-fill?

ROPER: I wouldn't say that I had any preference. Philosophically, what we have said is that we are looking for a very high level of treatment. People have described this in many different ways. Some have said we want zero discharge, but zero discharge is a difficult term to interpret. If what is meant is zero as an absolute quantity---nothingness---then use of the term is meaningless. It's not attainable. Even if it could be attained, I doubt that it would be desirable, for the end product would be distilled water. I don't think we want distilled water in our streams, even if we could produce it at any kind of a sensible cost. So what we are talking about really is a high level which approaches zero, but without being absurd---and there are several different ways to do that, based on the existing treatment plants. Present treatment plants involve the primary treatment which, for the most part, is the removal of grit and debris and that sort of thing. Secondary treatment is a biological process which reduces the oxygen demand on streams and in the process takes out some other things too. This, basically, is the kind of treatment that we have in this country today. To achieve a higher degree of quality in waste effluent, chemical processes can be incorporated into that system. Some people refer to this as a tertiary treatment which results in a very high quality product. The same end can be attained by starting fresh, eliminating the biological process as a secondary, and just treating the waste water in a chemical-physical plant which provides a high level of treatment through a series of chemical and physical processes. The third alternative is to treat waste water up to a point and then, rather than run it through the advanced physical-chemical processes, put this water on land. Let it filter through the surface of the land to a depth of five or 10 feet---or whatever depth is appropriate depending on the soil---, collect it in a system of under-drains and bring it somewhere for appropriate re-use. This also achieves a high level of quality. In the case of our Chicago study, in fact, it showed that we achieved a higher level of quality at lower cost by the land treatment than we did by the other two. In using a treatment plant approach, chemicals are mined from the earth, processed, then put into a plant somewhere to treat the water, leaving the problem of disposing of the solid residues. On the other hand, in a land treatment situation, the chemicals already exist in place, so all that is necessary is to get the waste water to the location where the chemicals exist and let the land---or nature---take its course, as it were.

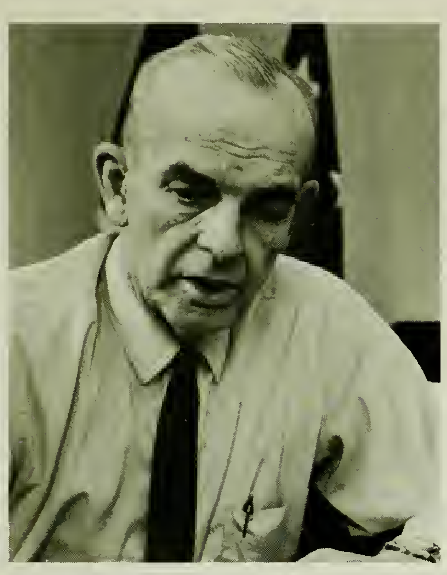
engr: General, regarding this "living filter" system---has it been programmed and used in the past? We understand that it was used overseas. Is that correct?

ROPER: I suppose it's been used for eons. Even before man inhabited the earth, the natural fall of water contained some things which could be called contaminants. And those were filtered through the soil as they reached down into the ground water and into the rivers. So the soil has, since the earth's creation, performed a cleaning or a cleansing function. But as to deliberate systems, traces can be found back in ancient history. Modern man has gone to something more sophisticated---namely, a plant arrangement of some kind. A few people have departed from that philosophy and have used, or are using land systems. Probably the largest one---and the one which has been in operation the longest period of time, at least that we know of---is in Melbourne, Australia. It handles the entire metropolitan waste from that city. Yet it is relatively primitive compared to the kind of systems that we're thinking about. But it has performed extremely well, and the land on which the waste is disposed has proved to be the basis for a very productive farming operation. There are other installations—some pilot work at Penn State University, for instance; and, more recently, a contract has been awarded for the construction of a major land disposal system in Muskegon, Michigan. Tallahassee, Florida uses a land disposal system which takes care of about 60 percent of that city's waste. So there are some systems in use here, but it has not been used on a large scale in the United States. There are a number of small ones---Golden Gate Park in San Francisco, for instance. A lot of golf courses around the country use them. There is a farm in Pennsylvania which operates on this basis. The largest that we know of, however---as I mentioned previously---is the one in Melbourne, Australia.



engr: General, would you describe briefly just how this filter system works? And what part lagoons have in its operation?

ROPER: Let me describe the concept that we developed for the Chicago area---and while this would not be precisely the same for any other community, it would have many characteristics in common. First, the system in the Chicago metropolitan area collects the waste. Included in that waste, as we define t, would be that from municipal sources, industrial sources and storm run-off. Rather than processng this waste water through a plant system, it is channeled into a tunnel and finally brought into one central tunnel which takes it out into a rural area about 50 miles south of the Chicago Loop. The total length of the main tunnel is about 100 miles. This waste water flows by gravity all the way to the terminus, which in this study is the Kankochee River Basin. At the terminus, the waste water is 1,100 feet underground in a tunnel about 25 feet in diameter in rock. At that point, a one million horsepower, or larger, pumping plant raises the water to he surface, after which it is put hrough what is called an aerated agoon. Two of those are contemplated in Chicago. These are relaively small lagoons in which there s a device which bubbles air hrough the waste water. This, in urn, creates a situation which is equivalent to normal secondary reatment. From there the water is moved to eight storage lagoons. These are three miles on a side. So you have a total of 72 square miles of surface area, about 25–30 feet deep. The lagoons will handle storage for about 150 days of flow, which is necessary because it cannot be disposed on land in the winter or when it is raining. The next step nvolves removal of the water from the storage lagoons, chlorination and transmission out into the land disposal area where big, low-pressure spray irrigation rigs of the kind that may be seen out west are employed to spray it onto the ground. It filters through the soil to a depth of from five to 10 feet where it gathers in underdrains and is brought back to the other side of



the area and channeled into a conduit so that it flows back into the Chicago metropolitan area by gravity. At that point it enters the Little Calumet River. Part of it is diverted into Lake Michigan and part of it down the river system.

engr: After that water is filtered through the ground---is it potable?

ROPER: Oh yes, it's better---within drinking water standards. The amount of phosphorous in it, for example, is so minute that it's about equivalent to that found in natural ground water that has not been tampered with in any way by man. It has no viruses, no pathogens, no trace of metals. It has a few things ---residues---which might be called contaminants, but they are at levels that are minimal. It is an extremely high quality product. In fact, it's a higher quality product than can be obtained from any plant-type treatment system that we know of today.

engr: Then this a much more economical system than the chemical process which you mentioned previously?

ROPER: In the Chicago study it shows up quite favorably from a cost viewpoint---not only with respect to capital cost, but also with respect to operating and maintenance costs. I wouldn't guarantee that it would always be the most economical solution. I can conceive of situations where perhaps the distance this water would have to be moved for disposal would run the cost up to an unacceptable figure. Or difficulty in finding proper soil would create problems. I think we really have to study each area on its own merits and look at the alternatives, or combination of alternatives, to see which is the best solution for that particular area.

engr: General, there have been a number of solutions advanced as to how to dispose of sludges---dump them in deep water---bury them in landfills---but such methods are being frowned on today. What are you doing about them? Is it true that they are being used for soil conditioning and fertilizer?

ROPER: First, you must recognize that we are not really doing anything with them at all. We are doing some planning for what we think should be done with them. Sludges from any one of the systems---whether it's a land disposal system which has sludge, or a treatment plant system of either type I mentioned earlier---contain solid material which must be disposed of, and I think it's foolish to waste it by burning it, dumping it at sea or by burying it deep in a land fill. There are many very valuable assets in that sludge and the logical thing to do is to make use of it. The best way is to use it on top soil in qualities that permit beneficial use. What it amounts to, and again I use the Chicago study as an example---the sludge from the advance biological system would be taken to the same area we envision using for the land treatment system, disposed of on the ground and cultivated for crops. The area, of course, would be much smaller than that required for a complete land disposal system in which the land is irrigated with waste water after having removed some sludge. Identical procedures are used in the physical-chemical system. The sludge is taken to the same area, spread on the ground and used. One difference does enter the picture here. The sludges pose more problems because of the type of treatment, and the rate of application therefore has to be much less which necessitates a much larger area. For land treatment systems, the storage lagoons previously mentioned accumulate sludge on the bottom very slowly. After a number of years---probably 10 to 15---a hydraulic dredge would be required to remove the sludge from the bottom of the lagoon and dispose of it again on land. In the interest of economy, it would be disposed of in the area immediately adjacent to the lagoon so as to reduce transmission costs. I think it's been but very recently that people have given serious considerations to making some really beneficial use of sludges. I think it's an excellent material for agricultural purposes if used properly. So it just seems only sensible that's the way it should be used. In fact, if you want to get down to a kind of basic philosophy, a pollutant is just an asset out of place. If you can collect these pollutants and do something useful with them, it just makes good economic sense, and good ecological sense to do so.

engr: Would this sludge have to be mixed in a ratio with other material to make it useable?

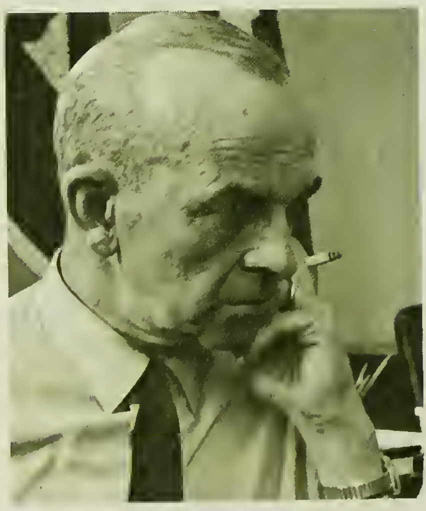
ROPER: Only with soil, I would say, as a general observation. It would have to be applied to the soil at such a rate whereby it wouldn't build up beyond the point where it would be useable. Heavy metals, for instance, can be accommodated in the soil and in the plant life, provided there isn't too high of a concentration. So for each type sludge, the disposal system would have to be designed accordingly.

engr: How long have you been conducting these in-depth studies?

ROPER: We began with the feasibility studies in February, 1971. Feasibility reports went forward in August, 1971, and we embarked on the more detailed studies beginning in December. We intend to complete the detailed studies in the four areas in which we are proceeding by the end of this calendar year.

engr: Do you have a five-year plan in which you expect to have your universal type system in effect?

ROPER: Well, at the moment there is no precise timetable. Bills have been enacted in both the Senate and the House, which set some dates for completion of planning, for example, but obviously the rate at which we accomplish plans depends on many factors. One would be the number of studies we are called upon to do. Another, of course, is the amount of funds made available to us. For any given study, we are thinking in terms of from two to two and one-half years for completion of a sufficiently detailed study which would permit somebody to use that plan for translation into detailed engineering construction. Regarding the total program we have right now, I mentioned the five pilot studies, of which four are proceeding into the detailed stage. The fifth one will do so eventually, although probably in a somewhat different form---perhaps I should say a bit different area coverage. The other four are in a detailed study stage and will continue. More or less concurrently with those studies, we undertook two others in response to appropriate authorization. One was a study of the Cuyahoga River which flows through Cleveland, Ohio, a river which has caught fire a couple of times. Basically, we have authority to establish a plan, subject to the approval of the Secretary of the Army, to restore that river to good quality. Actually, the waste water study of the Cleveland-Akron area has taken over the authorization that was originally in the Cuyahoga study to a great extent, although we are doing both concurrently. The Cuyahoga study will be somewhat of a peripheral study to the central one, which is Cleveland-Akron. Another small study we re-oriented involved the Codorus Creek, a tributary of the Susquehanna. That study is essentially complete and will be available for review by the Board of Engineers for Rivers and Harbors within the next month or two. It is a waste water study, undertaken as a part of the Susquehanna study. During the Fiscal 1972 appropriation hearings, two additional studies were added by Congress---a waste water study of the Colorado River in Texas, and an urban study for Omaha. Both are in the pilot study stage at the moment. An urban study is a bit different than a waste water study in that it includes a wider range of water problems. Waste water is, however, an integral, and in some cases, the dominant component. Confining a study to waste water alone is somewhat difficult because it has a bearing on



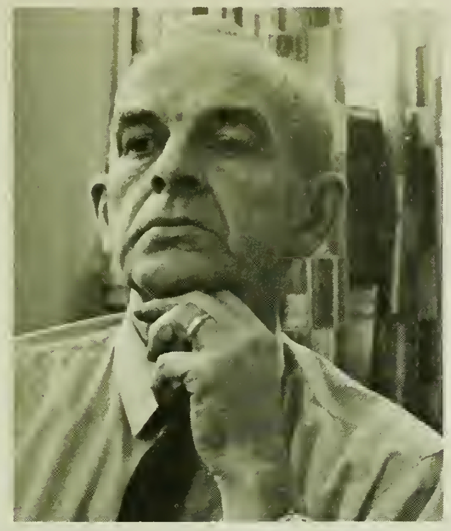
storm water and this, in turn, bears on storm water design for flooding, which relates to water supply and perhaps recreation---the whole range of water problems for any metropolitan area. The newer studies, therefore, are broader in scope, but retain waste water as a central feature. The President's budget for Fiscal Year 1973 proposes seven more studies---at Seattle in Puget Sound, Spokane, Boise, Duluth, St. Louis, Kansas City and Denver.

engr: These are all in your new starts?

ROPER: These are in the proposed new starts in the President's budget. In addition, we have received resolutions from the Congressional Public Works Committees for quite a number of others. Of course, a resolution carries no money with it, but we have resolutions on Atlanta, New Orleans, Baton Rouge, Miami, Louisville, Lexington and Frankfort, Kentucky. As we have gotten into this program it has appealed to many people---they see that it is logical for an agency that's been in the water business for a long time to come in and try to come up with something a little different than the conventional processes which so many people have found unsatisfactory under today's standards.

engr: How will the Corps fit into this over-all picture? Will you provide the expertise for each of these local or state communities?

ROPER: I would say not necessarily. A lot is going to depend on what the local people want. Right now, they have three options if they want to plan a system. They can do it themselves. So long as they meet the established standards, no one will question that. Another alternative is to seek a grant through the Environmental Protection Agency for planning. Today a grant can be obtained to cover as much as 50 percent of the planning costs. If they proceed in either of these ways, they will get some technical assistance of some type from the Environmental Protection Agency. The third alternative is to seek a necessary appropriation from the Congress for the Corps to come in and do a study. In cases involving the waste water management element, the local community must contribute to the effort so that it thus becomes a truly joint Federal/non-Federal undertaking. So those are their choices---they can go it alone, they can get a grant from EPA, or they can come to the Corps. I think more and more people feel that we have something extra to offer. I think that they are attracted to the kind of planning we are prepared to do. I don't mean to say that everybody is going to ask us to do it---I'm sure there will be some who would rather do it themselves for a number of reasons---with a grant preferably or without a grant if necessary. But the way this program planning seems to be catching on around the country, it would appear that we are going to have a pretty large and diverse undertaking for future studies.



engr: Don't you think this program is long overdue?

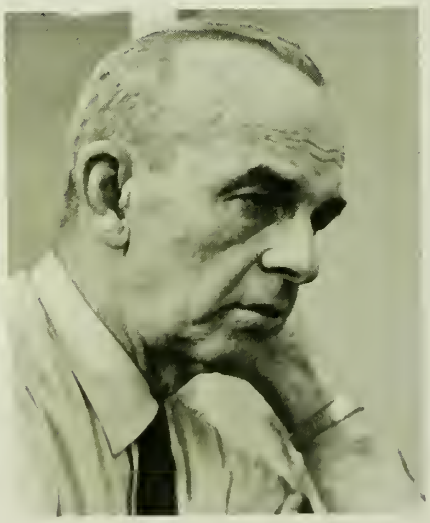
ROPER: Oh, I do. I think that in this country we have not really been aware until very recently what we were doing to our waters. We have tended to let economics dominate our thinking without realizing that if the problem was considered in the light of true economics the old way of doing things is no longer satisfactory. In other words, it makes good economic sense to try to produce a much higher quality in our streams than we have allowed to be created in recent years.

engr: Do you think this problem will be solved within the next five year period?

ROPER: It's hard to say. It is rather difficult to predict what studies we'll be asked to do, or what appropriations we will get. One of the foremost questions in my mind is when will somebody do something with one of these plans after we produce them? This is not within our control. I would say that within a few years we could cover at least the major problem areas in this country with plans of the kind I've been describing. But how long it would take to cover the entire country, and how long it would take the country to pick up these plans and translate them into effective action, I wouldn't venture to guess.

engr: What about the poor sewage? You have waste flow triggered by storms or heavy rains, and there are many poor sewage systems throughout the country---in Chicago or Los Angeles, for instance. How do you intend to tackle this problem? Will you ask for new sewage systems? Exactly how do you propose to improve that situation?

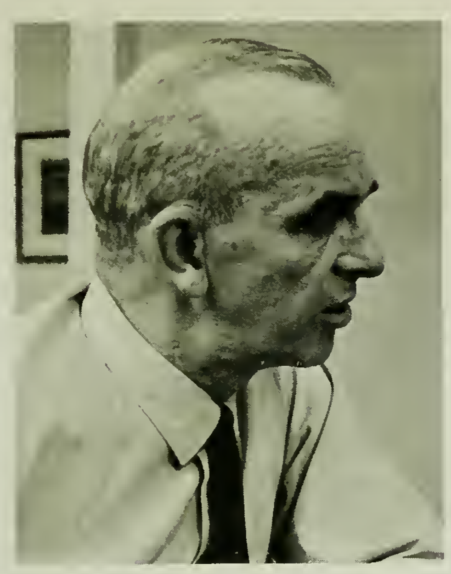
ROPER: Again, let's take the Chicago metropolitan area for example. Under these systems for which we have tentative designs, we would design the plans for the land treatment facility to accommodate the municipal flow, which is pretty predictable---the industrial flow, which is also pretty predictable---the suburban, urban and rural storm water run-off up to the 100-year frequency storm. Beyond the 100-year frequency, if you have a storm of greater magnitude than that some of this storm run-off would have to be diverted to by-pass the treatment facility. However, at that point in time in a rainstorm the storm run-off is not very contaminated. It's relatively clean and, from drinking water standards, it is still a pretty acceptable product. It's the first couple of inches that really give you difficulty. Now---how do you do that? The concept in Chicago is to establish what, in effect, would be reservoirs at each of the the treatment plants or at each of the major intakes for the land treatment system. Also, abandoned quarries have been identified in each location as being quite suitable for this---except in one place, where it would be proposed to use an existing mine. When the storm water begins to come in and the capacity of the plant is exceeded, it would be put into this holding area rather than diverted to streams and then processed through the plant as the loads gradually increase. For the rural areas, we have suggested creation of a system of 400 small reservoirs or ponds or detention bases in the existing streams which would collect the storm water run-off and hold it. It could then be used for recreation, fishing and wild-life purposes, and so on. When the lands begin to dry out during the summer, the water would be put back on the farms from which it came by means of an irrigation process, or a spray irrigation system. The system which is described in the special study for Chicago collects all of the municipal waste, plus all of the strom run-off from the urban, suburban and rural areas up to the 100-year figures. In speaking of the industrial component of this waste, it should be realized that there will be a few things which none of these systems could accommodate. An example would be some of the toxics which industry would have to remove before putting that waste into the system. What we're talking about are minute loads in terms of volume. One other thing I'd like to point out is that if the water is cleaned up more is accomplished than just the cleansing. It provides an opportunity for re-cycling and re-use—which might better be called water supply. I can visualize, for example, in the middle portion of the Colorado River in Texas, that the most sensible way to create additional water supply there would be to clean up the waste water and then use it for the water supply, rather than bringing water in from some unknown and distant source. This would be true anywhere. If there is good clean water in the effluent returning to streams and lakes, then it is there to use and, of course, it could be used for many things. A land treatment system offers some other possibilities. I mentioned the storage lagoons in the land treatment area—there's an awful lot of water in those. In fact, there's enough water there to support the cooling of eleven 5,000 megawatt nuclear power plants, which would meet the needs of the Chicago area to the year 2,000. Speculate on the introduction of those power plants for a moment. They wouldn't be in a location that would bother anyone. They wouldn't be on the lake front. They wouldn't be on the rivers. They would be in a location accessible to plenty of water for cooling purposes, which would preclude the necessity of cooling towers and comparable systems. Actually, some improvement to the sewage treatment program would be realized, because by having that water warmer at the land treatment site it could be put on colder ground and perhaps prolong the season for irrigation. This could result in a beneficial digestive process. Finally, revenues would be derived from taxes for land use and water supply which would go a long way toward paying for the construction, operation and maintenance of this entire system. There also may be possibilities for incorporating solid waste disposal. Some of the old treatment plants, for instance, could be abandoned if these new systems were adopted---whether it be a land type system or a plant type system. In addition, it may very well be that some of those abandoned plants could be put to other uses for the benefit of the community. There are also other possibilities. By bringing this clean water into Lake Michigan a basis for using it later on would be established. In other words, use Lake Michigan as a reservoir. Put more water in there than is required under the law, keep it there, and take it out when needed for some other purpose. I also think there are some significant economical opportunities associated with this system that are not readily identified and which we did not try to cost in any way in our Chicago study. We identified them and gave some order of magnitude in a couple of cases to



what it might be, but we didn't reflect a reduction in the cost of the system to be realized from power revenues. There is still another factor which should be considered in the land disposal system. Several hundred acres of highly productive farm land will be created in an area which presently has very low productivity. This has some rather significant economic value.

engr: What would have happened had you identified these problems? How long do you think it would have taken for these large metropolitan areas to really deteriorate?

ROPER: I think the nation generally began to get concerned about this in the last five to 10 years. In some areas of the country, some things were done prior to that time. The fact that we have primary and secondary treatment would indicate that there has been some interest. But the present high intensity of interest has developed relatively recently. Of course, some progress has been made. It wasn't many years ago that most of the discharges into the Ohio River were completely untreatable while today more than 90 percent of the discharges get some kind of treatment. The Ohio River today is a better river than it was 10 years ago. On the other hand, I don't think our progress in putting treatment facilities on line, whether industrial or municipal, has kept pace with our population and economic growth. As a result, we're doing a better job of treatment than we did in the previous generation. We now have a lot more people and much more material to treat. We were, at best, holding our own, which people came to realize was not enough. This can be seen in certain specific cases. For instance, Lake Erie has been called a dying lake---which it isn't by any manner of means. There are a lot of problems in Lake Erie caused to a very considerable extent by nutrients such as phosphorous and nitrogen that get into the lake in too large a quantity as a result of the treatment system. Here then, is another case where the land treatment in Chicago looks awfully good because there, for all practical purposes, phosphorous is eliminated as a problem. The treatment plant alternative, although satisfactory, does not accomplish that degree of elimination. When we first started working with water, people were interested primarily in navigation. Our first undertaking, I suppose, was the clearing and snagging work that was started on the Ohio River back in 1824. We stayed with nothing but navigation for many, many years. Then people started worrying about flood control. The worry started in the lower Mississippi Basin where the problem was most severe. It gradually became identified as a national problem because of a bigger concentration of people and the tendency to build in the flood plain and so on. Actually, we got into flood in some places fairly early. But the big push for us to get involved in flood control started in 1930 after the big floods---particularly on the Ohio. We picked up hydroelectric power as sort of an adjunct to flood control. If you build a reservoir, why not generate some power while you're at it to help pay for it? And I suppose when the Bureau of Reclamation came into the picture, irrigation became a purpose which we also included among our projects. After World War II, we began to develop a real interest in recreation. We found that these reservoirs which we had built without any recreational facilities suddenly became magnets and attracted millions of people. So the Congress gradually responded to the desires of the people and enacted legislation which allowed us to incorporate the recreation feature. Now the national interest has moved into another area---the purity of water in the streams. What we are doing today is in response to that national demand just as back in 1924 it was responsive to navigation improvement.



engr: The environment today is one of the big programs and we would think that the waste water program is going to be a large factor in cleaning up the environment.

ROPER: There's no question about that. It certainly is a major aspect of the environment.

engr: Is there any major area in the United States where you really do not have a waste water pollution problem right now? If the answer is no, do you have any kind of hopeful time schedule that we can expect positive action?

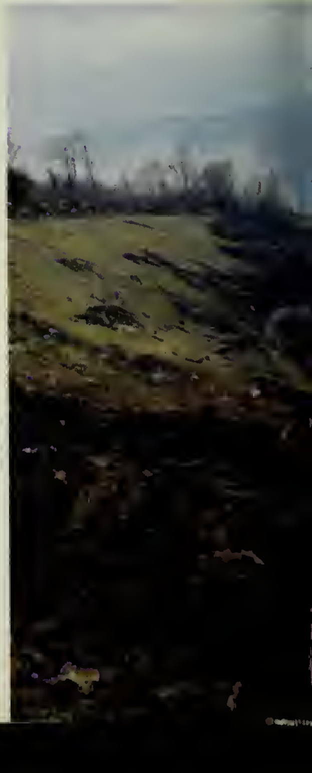
ROPER: The answer is no. We will produce studies for four of those troublesome areas by the end of this year and even before that we'll produce a study for a small troublesome area and put it on the street. From then on it's up to others as to how fast they want to go. We can't control that. What we have said was that we should design systems to meet the needs of the year 1990, but with components which would fit the most urgent character. e

America the Beautiful---

Oh beautiful...

for spacious skies...

for purple mountai



n retrospect

for amber waves of grain...

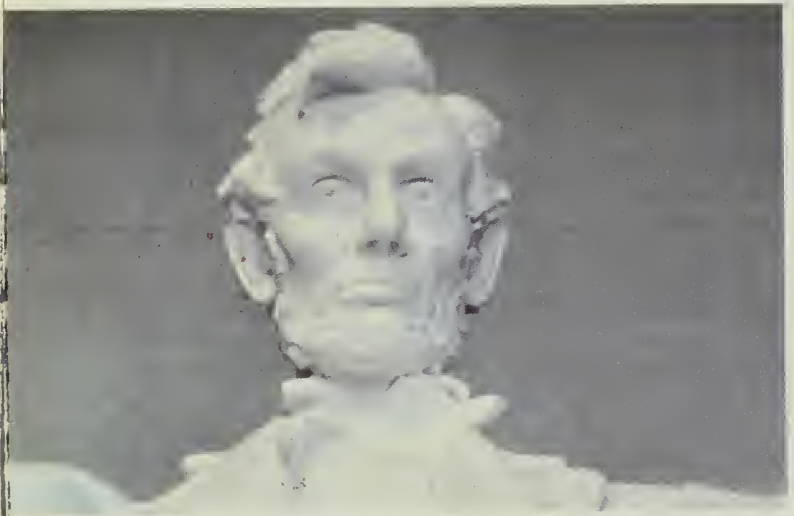
sty...

above the fruited plain.

America, America...

God shed His grace on thee...

and crown thy good with brotherhood...



The alarm has been sounded. It has been heard by all and as the debate rages over how badly man's technological advances have damaged the environment, the engineer has taken an objective approach. It has been said that man has terribly upset the ecological balance of his planet with his "soft living" habits. It also has been said that the so-called "environmental emergency" is nothing more than poor management of scientific and technological problems. These photos were taken by engineer staffers within a 200-mile radius of the Nation's Capitol. They prove that there is a pollution problem and that we must act---NOW! e

from sea to shining sea.

The Henry Larcom Abbot Award

AMERICA'S LEANING TOWER OF PISA

Capt. Mark W. Miller

One of the most famous European landmarks still stands today in all its splendor in Pisa, Italy. But the "Leaning Tower of Pisa," as any engineer knows, is the premier example of foundation failure. Completed in the 14th century on an uneven subsoil of volcanic ash, the tower is now more than 17 feet out of plumb in a height of 179 feet.

And the United States almost compounded this engineering imperfection with an infamous landmark of its own---the Washington Monument. Needless to say, if the monument that was erected in the Nation's capital to honor the "Father of our Country," today had a tilt comparable to the "Leaning Tower of Pisa," the structure not only would be degrading to the man it purports to revere but embarrassing to the country and engineers who condoned its construction.

How many persons know that the Washington Monument had, in fact, moved out of plumb before it was even one-third completed? Not many! And how many engineers realize that the difficult task of completing the "leaning" monument was assigned to the U.S. Army Corps of Engineers?

The construction of the monument originally was launched in 1848 by civilian engineers under the direction of the Washington National Monument Society. Within six years, however, the Society had exhausted all of its funds and had to stop construction at the 156-foot-level. In 1876, some 22 years later, Congress appropriated the necessary funds to resume the construction under government ownership and by the direction of the Corps of Engineers.

Before beginning construction, the Corps examined the sufficiency of the foundation and found three major problems: One, the foundation rested upon a compressible layer of fine sand and clay that was already loaded to its limit. Two, the foundation was out of plumb and this was causing the top of the monument to tip 1.4 inches to the northwest. Three, additional weight, naturally, would increase the total amount of the inclination.

The first construction the Corps undertook, therefore, was to strengthen and enlarge the original foundation. To accomplish this task, 70 percent of the earth upon which the monument stood was removed from around the perimeter of the old foundation and replaced with a concrete slab 13.5 feet thick.

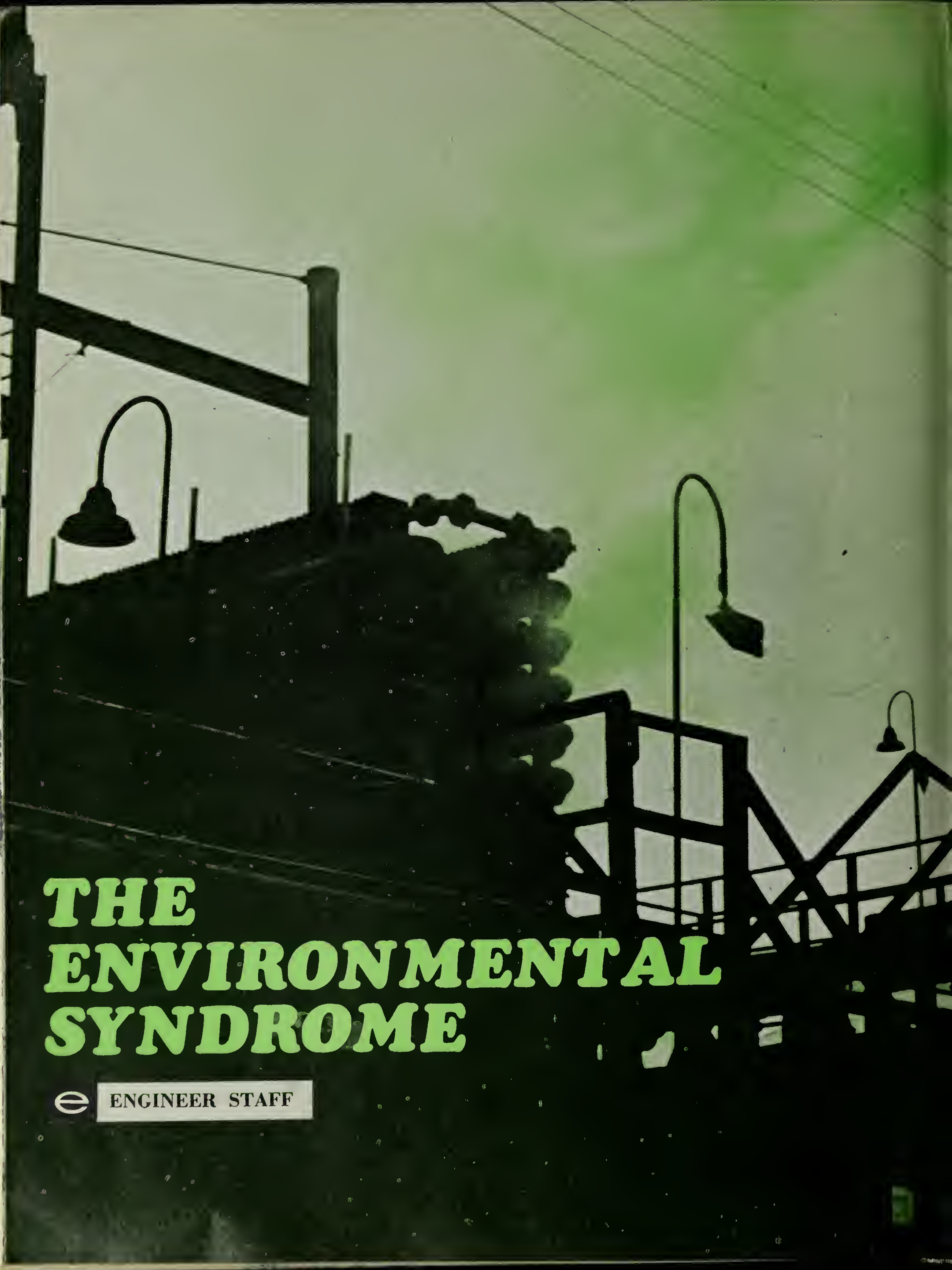
The effect of this effort was to enlarge the pyramidal shaped base from 80 to 126.5 feet square and from 23.33 to 36.83 feet deep. Next, concrete underpinnings were built out onto the new slab, requiring the removal of 51 percent of the old foundation. These buttresses served to distribute the weight of the monument over the entire surface area of the enlarged foundation base.

This difficult and delicate excavation work was not completed without some disturbance to the 156-foot in-place column. The entire column settled an average of two inches, with the southeast corner settling almost .5 inches more than the northwest corner. This uneven settlement, however, was completely controlled by the engineers and actually served to straighten the monument from its known deflection of 1.4 inches northwest into a vertical position. Furthermore, this truly remarkable engineering achievement did not cause the slightest crack in any joint of the monument.

In 1880, after three years of diligent effort, the foundation work was completed. The remainder of the monument's construction was accomplished quite rapidly, except for occasional delays caused by material shortages.

When the engineers placed the capstone at the 555-foot-5⅛-inch level in December of 1884, the Corps completed a distinguished chapter in its growing history. It is perhaps not so surprising to note that Lieutenant Colonel Thomas L. Casey, the officer responsible for strengthening the foundation and completing the structure to its full height, became the U.S. Army's Chief of Engineers only four years later.

Captain Mark W. Miller is a recent graduate of the Engineer Officer Advanced Course at Fort Belvoir, Virginia. A graduate of the United States Military Academy, he was recently presented the Henry Larcom Abbot Award for excellence in writing based on his presentation of "America's Leaning Tower of Pisa."



THE ENVIRONMENTAL SYNDROME

ENGINEER STAFF

> *Therefore shall the land mourn, and everyone that dwelleth therein shall languish with the beasts of the field, and with the fowls of heaven; yea, the fishes of the sea also shall be taken away.*
>
> **Holy Bible Hosea 4:3**

Once again the bugler's call for help has been sounded to the U.S. Army Corps of Engineers. Neither is the enemy armed nor will the fight be waged in some remote corner of the world 10,000 miles away. The enemy is pollution and the battle will be fought "in our own backyard."

The fight is on to save the environment of this nation, and the Corps has been tasked to draft a battle plan. The Department of Defense and the Environmental Protection Agency will lend all possible assistance, but the onus for actual work has been placed directly in the able hands of the Corps of Engineers.

Some experts, however, regard this action as being about 70 years too late. They regard America as already being in an advanced state of environmental decay because of negligence. At some point in time over the past three-quarters of a century, those charged with care of the patient began to pay less and less attention to its health. Now the remedial measures that are expected to provide some relief may well prove to be ineffective. The underlying cause of the illness has been diagnosed as "environmental neglect." Many are responsible.

At one time the air was pure, the earth was fertile and water was sparkling clean—long ago, before man inhabited the land. As we now move into "the environmental decade," we do so with the realization that pollutants have begun to threaten man's very existence.

The natural environment has suffered from technological progress and modern man's "instant" life style. The true culprit is man. The Corps must find the answers to many complex questions in this ecological struggle for survival. In the process, it may well be determined that man himself has only himself to blame.

The battle plan calls for two Corps of Engineers directorates—Military Construction and Civil Works—to carry the fight on all fronts against pollution.

The Directorate of Military Construction, headed by Major General D. A. Raymond, is charged with the tremendous responsibility of eliminating pollution from within the Army establishment. The Civil Works Directorate, under the leadership of Major General John W. Morris, is deeply concerned with and involved in conservation-related fields.

President Richard M. Nixon has called this the "environmental decade," and has taken definitive action to counteract many of the harmful practices that are responsible for the alarming deterioration in the environmental and ecological condition of America.

When the President signed the National Environmental Policy Act (Public Law 91-190) into law on January 1, 1970, the national policy governing environment changed. The new law directed the U.S. Army, among other Federal agencies, to carefully consider factors having possible influence on the environment in their decision-making process or in making a determination as to a course of action. Federal agencies can no longer slight environmental concerns in pursuit of accomplishing their primary missions without definitive plans to offset the development of possible harmful side effects. In the past, traditional quantitative factors such as costs involved and engineering feasibility for a project, usually took precedence over in-depth consideration of the environmental impact. This is no longer true.

It is anticipated that controls for the protection and enhancement of the human environment—Federal, regional, state, and local—will, in the near future, become more and more rigid.

President Nixon has proposed a number of pollution control measures which are applicable to Army posts, camps, and stations. He has asked for an improved program to cleanse our waters, and to recycle wastes into useable materials. Under his recommended program, the use of pesticides will be restricted. Precipitate poisons will be banned on public lands, and toxic wastes will be regulated. By 1976, sulphur oxide expelled from smokestacks will be curtailed and the monies available for research into noise abatement will be increased.

The Corps of Engineers will play a major role in implementing, in detail, the broad guidelines set forth by the President. In fact, the Department of Defense and the Army, through the Chief of Engineers, Lieutenant General Frederick J. Clarke, already have taken steps to upgrade the operation and design of existing Army facilities by providing for research in support of master planning, design, construction, operation, maintenance, and disposition of such facilities. These activities are in various stages of planning and implementation today.

Concurrently with this program of qualitative improvement of existing military facilities to conform to current air and water pollution standards, the Chief of Engineers also faces the need for identifying the Army's role in environmental protection and enhancement in connection with short, intermediate, and long-range military construction.

The Corps is continually engaged in construction projects to insure that existing Army facilities conform

Petroleum contamination of open streams, such as this one, leaves damaging effects on the woody vegetation around the banks. The effects have been verified by analyzing tree ring growth over periods of time, ranging as long as 15 years.

to current water and air pollution safeguards. In these two vital areas, the Army has more than doubled monies spent on water pollution control safeguards—from $16-million in FY 1968, to almost $35-million in FY 1972. In FY 1972, fund expenditures for air pollution control safeguards were 15 times those of FY 1968.

The water pollution control program involves a number of various types of projects, such as secondary sewage treatment, industrial waste treatment, washrack grease interceptors, separation of storm and sanitary sewers, and waste neutralization.

Air pollution control embraces such projects as fuel conversion, substitution of land fills for incinerators, precipitators for boilers, and fume scrubbers. Most of these pollution control measures are state-of-the-art applications. Quite recently, however, the Army came up with a solution to a nagging pollution problem which it anticipates will have a far-reaching impact on—and prove to be advantageous to—industrial firms.

A forthcoming project, sponsored jointly by the Army and the Environmental Protection Agency, is designed to demonstrate to industry a means of controlling nitrogen oxide emissions from nitric acid plants. The Army has several such plants and is deeply concerned with the latest developments in nitrogen oxide control. One such plant is at the Holston Army Ammunition Plant at Kingsport, Tennessee.

The planned project involves the demonstration of a molecular sieve which has been developed by the U.S. Army Construction Engineering Research Laboratory to control nitrogen oxide emissions from nitric acid plants.

The molecular sieve process involves a catalyst bed which absorbs the oxides of nitrogen. It is regenerated periodically by driving off the nitrogen oxide with heated air and returning its concentrated steam to the manufacturing process.

Engineer experts in the field say the demonstration should prove it possible to meet current emission standards promulgated by the Environmental Protection Agency and, hopefully, will enhance future standards by achieving emission of one-quarter of that being expelled into the atmosphere today.

The Corps recognizes that one of the more important aspects of the battle against pollution is the necessity of educating those in positions of responsibility where corrective measures can be initiated. The Office of the Chief of Engineers has embarked upon a program designed to insure that all possible information available is disseminated to engineering personnel through a series of five-day environmental workshops conducted at field and headquarters activities for those actively involved. In these workshops, students and instructors exchange information on environmental problems, new technology, and possible solutions to the problems which pollution imposes. They also review current Federal laws and guidelines, and particular emphasis is placed on the requirements for Corps "Environmental Impact Statements." Thus far, the workshop approach has been acclaimed a success because it has brought into sharper focus problems connected with the improvement of environmental pollution as related to the planning, designing, constructing, and operation of military installations.

The Chief of Engineers has been constant in his

Stream pollution is often caused by the structural failure of the storm drain and outlet energy dissipator. When this happens, as pictured here, the unstable downstream channel is scoured.

efforts to keep abreast of such problems involving Army construction. A modest research effort was made in 1970 to determine the immediate, mid-range and long range needs of Army construction. For these categories, the objectives established were—

- Immediate—to provide assistance in meeting present standards.
- Mid-Range—to provide the means with which to apply the "best Practical Technology" by 1976.
- Long-Range—to provide a way to reach zero pollutant emission by 1981.

The Corps also is trying to provide all possible practical means of enhancing the quality of the human environment on military installations. New information will be reflected as guidance in appropriate Engineer design and construction manuals, guide specifications, and directives.

At the installation level, the Facilities Engineer is tasked with the responsibility of influencing the quality of the environment. How well his organization collects, treats, controls, and disposes of such forms of waste as domestic sewage, industrial wastes, solid waste in the form of garbage, stack emissions and fly ash from heating plants, and vehicle exhaust emissions, will have a direct bearing on the quality of both the environment at the facility as well as the environment immediately surrounding it.

The Engineer Research Systems Laboratory has been busy too. In 1971, the laboratory program was directed primarily toward assisting management in defining the environment and in the preparation of environmental impact statements. To date, the Corps has filed 542 environmental impact statements (236 drafts and 306 final statements) with the Council on Environmental Quality. Steps were also taken to find ways to abate pollution by classifying effluent characteristics, by defining impacts associated with all categories of construction operations and by developing criteria for separation of housing and noise sources.

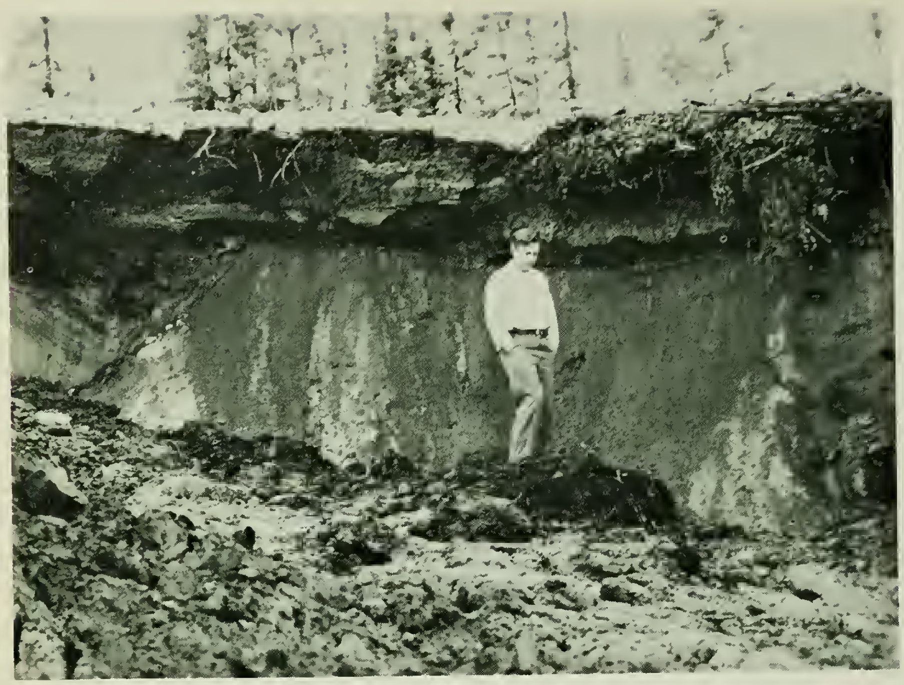
The Corps has initiated contracts with two schools that may have interesting results. One was initiated in 1970 with the Florida Institute of Technology to conduct basic studies of the effects of gamma radiation. Hopefully, these basic studies will determine the economics and effectiveness of radiation for sewage treatment or the recycling of waste water.

The second significant contract was initiated in 1971 with the Virginia Military Institute Research Laboratories. Its purpose was to develop detailed information and to analyze environmental impacts associated with all known categories of construction operations such as large scale land clearing, burning, excavation, blasting, paving, and building. Information generated by this contract is expected to define areas in which the Army can take corrective action in those troop and contract construction activities which introduce air and water pollution or adversely effect the quality of the human environment in other ways.

Corps of Engineers plans for Calendar Year 1972 include increased efforts in environmental quality management, pollution abatement, and utilities conservation.

The expanded program in environmental quality management will—

- Define environmental decision points associated with planning.



Permafrost degradation is common in Arctic and sub-Arctic regions. It takes only one summer season in those areas for exposed ice and permafrost to melt enough to cause the erosion that has severely lowered the surface of the embankment pictured here to this degree. In this particular case, it is hoped that the vegetative mat will eventually slump over the bank to control further degradation.

- Develop sources of information and procedures for environmental impact assessment.
- Develop automated environmental data.
- Review and exploit technology developments.
- Develop methods of defining site environmental characteristics or base line data.

The expanded pollution abatement program will—

- Complete definition of effluent characteristics now and in the future.
- Evaluate construction activity impacts and means for controlling them.
- Evaluate performance and cost of existing abatement systems and define any needed revisions.
- Develop advanced abatement systems.
- Define solid waste management techniques for theater of operations.

The expanded utilities conservation program will—

- Develop overall installation (community) concepts for reducing the magnitude of pollution sources such as fuel combustion, solid and liquid waste, and water consumption.
- Review and improve operating and maintenance procedures.
- Evaluate potential of low pollution energy sources.

All of these programs are being planned and conducted at the U.S. Army Construction Engineering Research Laboratory, the U.S. Army Cold Regions Research and Engineering Laboratory, the U.S. Army Engineer Waterways Experiment Stations, and the U.S. Army Engineer Power Group.

After seeing an overview of the Military Construction Directorate mission in the pollution firefight, let's take a look at the other side of the coin. The Civil Works Directorate has a tremendous task ahead in its quest to arrest pollution and clean up the environment. The Civil Works people currently have more than 300 ongoing environmental protection projects in the mill—dam building, navigation, flood control, estuary preservation, and recreational facilities.

Highlights of some of the Civil Works projects are—

- Item. The Corps, as the principal planner and developer of America's water resources, has responded to the changing needs of the nation for the various benefits of water resources development. Planning techniques are being scrutinized and revised to insure that they accurately reflect concern for environmental values.
- Item. Many Division and District Engineers have established internal and ad hoc advisory committees to screen all laws, executive orders, regulations, and directives to assure compliance and to identify environmental problems. And right now District Engineers are modifying their planning procedures to insure early and continuing public participation, early and continuing consideration of environmental factors, and vigorous exploration of a full range of project alternatives.
- Item. Environmental specialists have been added to the staffs of the Planning Division of the Civil Works Directorate, the Board of Engineers for Rivers and Harbors, the Waterways Experiment Station, the Institute for Water Resources, and the Coastal Engineering Research Center.
- Item. The program to provide new water supply and sewage treatment facilities at public use areas on Corps projects has been accelerated and expanded.

- Item. Provisions have been made for sanitary dump stations for holding tanks in travel trailers and boats at Corps recreation areas.
- Item. The reservoir operation schedule has been reviewed and changed to enhance fish spawning, hold higher water levels during the recreation seasons, minimize later summer exposure of mud flats, and to provide additional flows for downstream water quality.
- Item. Civil Works has conducted, sponsored, and participated in many litter clean-up campaigns on Corps projects.
- Item. Civil Works has instituted procedures and actions to dress up the appearance and make better utilization of soil banks, borrow pits, and quarry areas to include landscaping and sodding with grasses.
- Item. Civil Works has eliminated open pit burning on Corps projects through conversion of waste disposal to sanitary land fills.
- Item. Field offices have expanded their efforts in preparing and implementing forest management plans and ecological vegetative management plans on complete projects.
- Item. Civil Works has incorporated leases, licenses, and concession agreements of stringent conditions regarding environmental quality standards and activities that may degrade the quality of the environment.
- Item. Civil Works has modified all Corps of Engineers' floating plant installations to provide adequate facilities for the treatment or retention of sewage.
- Item. Civil Works holds pre-construction conferences with the contractor to review and discuss environmental aspects of the work, the plant layout, location of construction roads and living areas to minimize their impact on the environment.
- Item. Civil Works continues to expand vector and pest control programs.
- Item. Civil Works continues to expand tree planting programs.

One of the major programs of the Corps, of course, is the entire water resource development planning process. Many steps are being taken to involve the public in the program and to keep it apprised of the processes and mechanisms through which water resources problems are investigated and solved by the Corps. The Institute for Water Resources, for instance, is continuing the development of communication skills and techniques and consultant services for training and application by field planners to increase the effectiveness and scope of public involvement in planning.

And speaking about water, there is a story about our present water resources posture. It seems that a distinguished scientific researcher was participating in a panel discussion with other learned scholars recently to report on the results of a comprehensive study of the nation's future water supply in which he and his colleagues had been involved.

"Gentlemen," the scientist said, "I have some good news and some bad news for you. Our study shows that by the year 2020 everyone in the United States will be drinking recycled sewage from his home water tap."

"Great Scott!" came a response from one of the panel members. "Quick, tell us the good news." "My friend," responded the scientist, "that was the good news. The bad news is that there won't be enough to go around."

It probably is not all as bad as the scientist would make one believe, but the facts are clear that water, the resource—local, regional, or continental—may no longer be treated as an off-the-shelf item in great supply.

The Corps is working from the set of Environmental Guidelines developed by the Institute for Water Resources and adopted in 1970, to solve the ecological dilemma. These guidelines now constitute both the policy and the working regulations on the environmental aspects of all phases of the civil works program.

There are four basic objectives in the Environmental Guidelines toward which the Corps' environment-related activities are being directed. They are: to preserve important ecological, esthetic, and cultural values; to conserve resources and use them wisely; to maintain and enhance the quality and attractiveness of the environment; and to create new opportunities for the use and enjoyment of the total natural heritage.

The guidelines actually provide a detailed check list of measures that are to be taken in pursuance of the policies and objectives through all stages of project formulation.

With the guidelines to help it along, the Corps has been instrumental in the development of the Water Resources Council's multiple objective planning approach. Also five regional waste water management planning feasibility studies (see interview beginning on page 4) have been initiated in major metropolitan areas around the country under present authorities and funds and in close cooperation with the Environmental Protection Agency.

The Corps faces a long, hard grind in its battle to arrest pollution on all fronts and lead the way in bringing environmental considerations into the resource allocation and development process. It has met the challenge head-on and expects to come out the winner.

There might be another guideline for the Corps of Engineers to consider in the herculean attempt to protect and enhance the environment of this great nation—Davy Crockett's wise observation of 150 years ago: "Make sure you're right, then go ahead."

RECYCLING FOR SURVIVAL

Captain Lawrence D. Allwine

Practically every day we read, hear, or smell something concerning pollution. One of the least mentioned forms of pollution but one receiving more attention each day is solid waste---garbage, wrecked cars, cans, newspapers, and bottles. Current estimates indicate that about 250 million tons of household, commercial, and municipal refuse are annually generated in our nation.

We have turned into a "Use It-Throw It Away" society thanks to a remarkable technology that has made a throw-away container the most desirable way to package things. The amount of solid waste collected from each person daily has increased from 2.75 pounds in 1920 to 5.3 pounds in 1968 and is expected to reach eight pounds by 1980. What will happen to it?

The sanitary landfill is presently the recommended method for the disposal of solid waste. It is a simple procedure which involves placing successive layers of compacted waste and fill dirt in prepared excavations or open areas until a predetermined fill elevation is reached.

Ingenious schemes for using the land after fills are completed have been devised, such as building parking lots, golf courses, parks and housing developments. Other methods of disposal also are being tried. A Japanese firm has compressed solid waste into blocks which are then coated with asphalt or cement and used as construction material. Some United States firms have shredded solid waste and used it as a soil conditioner in an attempt to make our desert areas bloom. Others have tried burning solid waste to supply heat for power plants. And some of our larger cities have built incinerators to reduce the total volume of solid material going into their landfills.

If we continue to rely on the sanitary landfill method to meet our future needs we will be limited by the availability of land. It has been estimated that the landfill method requires one acre of land for every 10,000 people each year for disposal of their solid waste. Also, the increasing use of packaged products in non-returnable containers (prepackaged meats and vegetables, milk cartons, bottles, and cans) multiplies the amount of solid material that is thrown away each year.

Experts have estimated that the current available land in New York City will be exhausted by 1975. When the available land is depleted other methods of disposal will have to be used. These other methods, unfortunately, have few beneficial qualities. Abandoned glass, metals and other inorganic waste do nothing for soil enrichment or contribute little for the conversion of water to steam or powerplants. Incineration just delays the inevitable---exhaustion of our available land.

The Corps of Engineers plays a significant role in solid waste disposal because of the hundreds of military installations that the U.S. Army operates worldwide. Each of these installations share the common problem of solid waste disposal. This problem, of course, is of primary concern to the Facilities Engineer at each post, camp, or station. At the Army Engineer Center, Fort Belvoir, Virginia, for example, more than 40,000 cubic yards of loose solid waste is deposited in the sanitary landfill each month. So, it is easy to see that the Corps of Engineers has a personal interest in finding new and better ways to dispose of solid waste.

You might ask yourself this question. Why should I be concerned with solid waste? You should be concerned even if you are not a soldier because it involves all of us as individual Americans. Local sanitation departments and the Corps of Engineers deal with the problem every passing day. We each contribute our share of the more than five pounds of solid waste per day. In addition, our population continues to increase by leaps and bounds. This increases the burden of handling solid waste disposal in this country each year.

From these simple facts, it should be clear that we are slowly depleting the available supply of ground that is suitable to be used for landfill purposes. When we have run out of available ground, what are our alternatives? The answers are still to come. Facilities Engineers on military installations and their civilian counterparts in the communities across this nation will have to find other ways to dispose of solid waste or we will begin burying ourselves in our own trash. The late Premier of the Soviet Union, Nikita Khrushchev, once stirred the world during an address at the United Nations. He pointed to the representatives of the United States at that historic meeting and said, "We will bury you!" Those strong words never were put to the test but this country could bury itself in trash.

Some things are being done. The Corps of Engineers has been doing limited studies on how to cope with solid waste disposal. But due to the lack of sufficient funding, the Corps has not been able to devote the ecessary effort to properly develop and evaluate its rograms. Various commercial industries are conducting their own research in the hope of coming up with orkable solutions to the problem of solid waste disposal. Now in the development stage is a promising new echnique called recycling. This is a process that separates the basic elements of solid waste---pulp, glass, lastics, ferrous and non-ferrous metals, and other organic materials---into usable products.

The Black Clawson Company has taken a leading tep in the recycling field. The company has successfully developed "Hydrasposal" and "Fiberclaim" plants hat can separate paper fibers, ferrous and non-ferrous netals, and glass from 40,000 pounds of mixed solid aste each day.

Local industries also have found the "Hydrasposal" nd "Fiberclaim" plants valuable sources of raw materials. Other successful applications of the use of recycled roducts include the composting of organic waste for oil fertilization, use of pulp in paper towels, and use of eclaimed aluminum for making new cans. The eventual uccessful use of these applications looks very promising at this time. But the experts claim that more research and development must be performed on recycling techniques before we will be able to produce the nore efficient separation processes we need.

This places the Corps of Engineers in a challenging osition. It already has placed its foot in the door of the roblem. Why not open it all the way by placing more mphasis on solving the growing problem of solid aste. Developing more efficient recycling processes ould be a giant step in the right direction.

President Nixon in his 1970 message to Congress on he environment said, "As we look toward the long-range future in 1980–2000 and beyond, recycling of naterials will become increasingly necessary not only or waste disposal but also to conserve resources. While ur population grows, each one of us keeps using more nd more of our earth's resources. In the case of many ommon minerals, more than half of those extracted rom the earth since time began had been extracted ince 1910. A great deal of our space research has been lirected towards creating self-sustaining environments n which people can live for long periods of time by eprocessing, recycling, and reusing the same materials." What the President said means we cannot regard olid waste entirely as something of little or no value, ut rather as a resource, something to be recovered and e-used whenever possible and practical.

The secondary material industry is a major and vital art of our economy and, hopefully, is in a logarithmic rowth stage. The National Association of Secondary Materials Industries, Inc. (NASMI), has in the past ear taken as its theme "Recycling Resources," and although the organization has not received much public attention, it has been of vital importance to industries with scrap problems. NASMI companies have a gross volume in excess of $7-billion. These companies annually process more than three million tons of nonferrous scrap metals for consumption by smelters, refiners, and ingot makers. They make available 45 percent of the copper used in new products, more than 50 percent of the domestic lead supply, 30 percent of all aluminum, and 18 percent of all zinc. More than 11-million tons of paper stock are recovered and processed by this industry for reuse. The average company investment is in excess of $1.3-million, quite a distinct change from the individual collector of many years ago.

Everyone is, or should be aware that the major component of municipal refuse is paper. Approximately half of the waste collected in our cities is paper in varying quality. Paper is already recycled at about a 20 percent level in the U.S.; other nations, notably those with a short supply of wood pulp, do a far better job. Japan recycles about half of its waste paper, and most European countries, such as West Germany, France, Great Britain, and Spain, recycle approximately one-third of theirs. We should hope our Nation increases its percentage of reused fibers.

One final, and possibly the most important reason why we all should be concerned with developing an efficient system of recycling solid waste into reusable products is the fact that we are exhausting our supplies of natural resources. Whenever an oil field is drained, an ore vein is depleted, or a forest is harvested, another one is located and worked until the resources are depleted. If we continue with our present "Use It-Throw It Away" philosophy, we will gradually exhaust our natural resources.

It does not take a mastermind to deduce that we have entered a race for survival. Our opponent, solid waste, is one that we have created and continue to feed with more and more non-returnable bottles and cans. Are we going to allow that enemy to overtake us and bury us in our own affluence? Or are we going to develop what appears to be the only long-range solution to the problems of solid waste disposal and the exhaustion of our natural resources? Someone will have to come up with a winning solution before we find ourselves buried beneath the trash and recycled back to dust.

Captain Lawrence D. Allwine is a recent graduate of the Engineer Officer Advanced Course at Fort Belvoir, Virginia. He saw service in Vietnam as a Facilities Engineer, supporting the Korean Tiger Division and holds a Bachelor of Science degree in engineering from Ohio University.

CLEAN AIR!
LOVE
BAN SMOG!
CLEAN WATER!!

IT'S ALL IN YOUR OWN BACKYARD

Captain Lawrence A. Willwerth, III

A group of young long-hairs gathered in front of the White House recently and sounded a clarion note amidst the usual protest invective. They screamed "stop pollution" and their various signs read, "Ban Smog," "Give Us Clean Air and Water," and "Put Sludge In Orbit."

The news media seized upon the situation and thoroughly exploited the issue. In fact, the demonstration and those like it have become a standard bill-of-fare on our evening television news programs.

Reaction to the demonstration was mixed. Some citizens showed little or no concern; others were worried. But at Fort Belvoir, Virginia, the reaction amounted to acute indignation.

"Those blasted kids. What do they want, anyway? Riots! Demonstrations! Everything is going topsy-turvy these days!" responded a Sergeant Major.

"You're right, Sarge," chided a Major. "These kids are tearing this country apart."

And a soft-spoken secretary lamented, "I don't know where it will end. I just don't know what they want."

"They don't know either," added the Sergeant Major. "They are only after the publicity. They don't know how lucky they are to be here today."

It is easy, sometimes, for those of us in the military to subscribe to a little self-righteous indignation based on our spit-shined, close-cropped approach to the grooming of our reservations and camps. And anyhow ---can the kids really be right about this pollution thing? After all, what they really want is a youthful leftist takeover of the government---or do they?

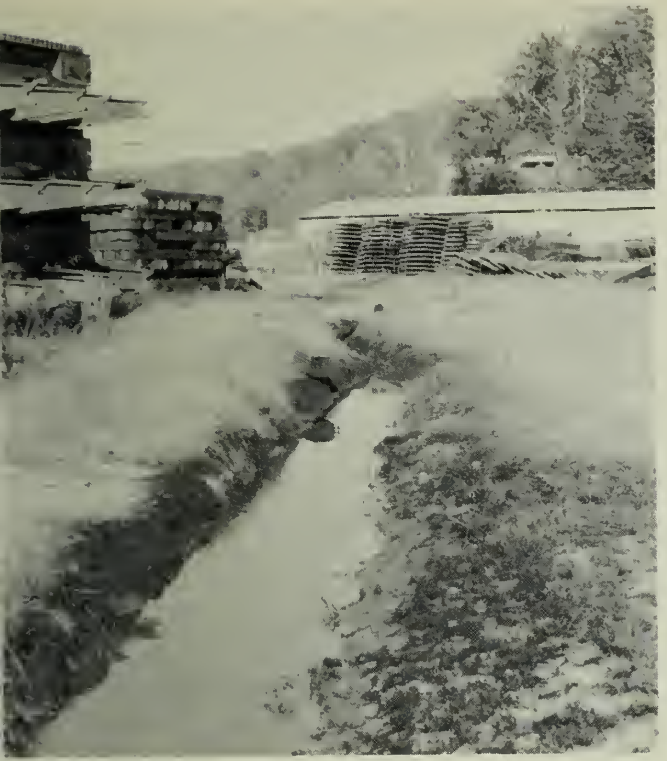
Let's take a closer look at pollution and then make an excursion into our own backyard.

Litter, one of the easiest kinds of pollution for the layman to identify, has been a problem for years and a joke to the average American. Water pollution, too, has been with us for decades but is characteristically more difficult to identify. And the list goes on and on.

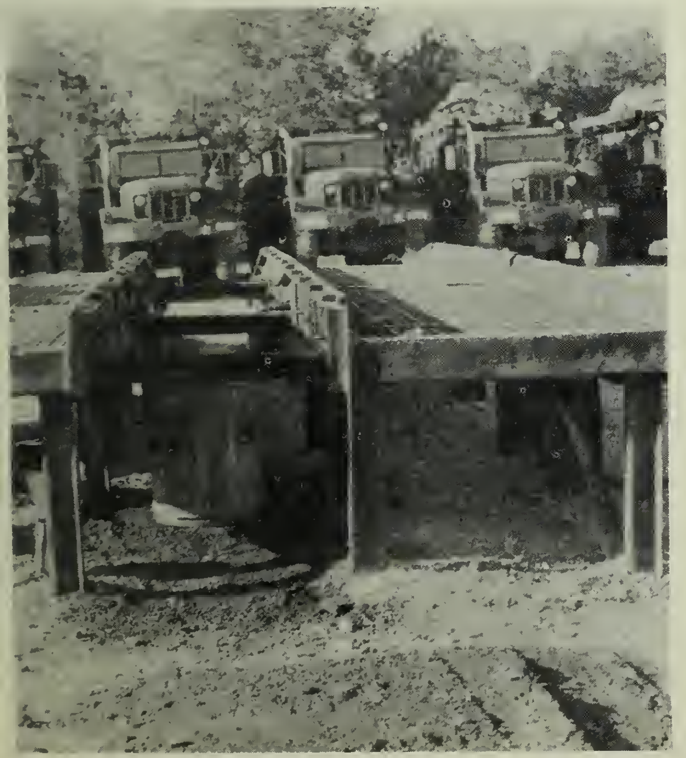
But we know about all of this now, thanks to the yellow journalism which has sensationalized disasters such as oil spills and widespread incidence of lead poisoning. We are all concerned, military and civilians alike. And as we shall soon see by what may be found in our own backyard, none of us are immune to pollution's infection.

Executive Order 11507, entitled "Prevention, Control and Abatement of Pollution at Federal Facilities," was introduced by President Richard M. Nixon in February of 1970 as an official acknowledgement that the Federal Government shares the indictment as a "polluter" with commercial and private enterprise alike. The order is the culmination of many years of government activity in the field of environmental quality protection and dictates new guidance for all government agencies concerned. The order also extends the existing "Clean Air and Federal Water Pollution Control Acts" and initiates a policy whereby the government provides national leadership in the protection and enhancement of our air and water resources.

Under Section IV, Standards, it states, "Heads of all Federal agencies shall insure that all facilities under



Here is a drainage ditch that flows directly into the Potomac River (top photo). Waste oil is constantly dumped in this area from the equipment park, causing permanent contamination of the entire section. The lower photo shows how the improper use of collection cans leads to direct dumping of oil on the ground.



their jurisdiction are designed, operated, and maintained so as to meet specific requirements." Another standard cited was the control, handling, and disposal of waste oil lubricants, a subject with which we will concern ourselves in the examination of pollution in our own backyard.

Executive Order 11507 specified that, "all installations must initiate actions to meet these standards by December 31, 1972." A later and additional Executive Order Number 11514, "Protection and Enhancement of Environmental Quality," added that "all agencies are directed to continually monitor these quality standards."

In view of these directives and existing Federal dictates, each military installation was faced with the enormous task of problem identification and qualitative and quantitative analysis of collected data. Each had to develop a system of reasonable controls and subsequently decide how to minimize or rectify existing damage.

Installation engineers were tasked to determine just what reasonable controls would be needed and decide just how to clean up and rectify whatever damage had been done. The requirements came at a poor time---decreasing Federal funds, reduced manpower resources, and inflated higher costs.

To try to solve the overall pollution problem, the U.S. Army's Corps of Engineers was saddled with the responsibility of cleaning up the environment for everyone. They hoped to do this through a system of controls and inspections that would ensure an end to the pollution problems of the United States and with it an end to the sign-carrying protestors.

So, the Corps went out to inspect the cities, the factories, the rivers, and the commercial concerns. But what about our own backyard? What about the enormous amounts of waste oils and lubricants that are being discarded on the ground at almost every U.S. military installation in the world?

When we look into our own backyard, what do we see? Is it clean? Or do the kids really have something here? For a real close look, let us examine a recent survey that was conducted at Fort Belvoir, Virginia, "Home of the Army Engineers." Fort Belvoir is a picturesque Army post located some 23 miles south of the Nation's capital. Resting securely along the lovely green banks of the Potomac River, it is only about five miles north of historic Mount Vernon, the home of our founding father, George Washington.

The Facilities Engineer at Fort Belvoir had long known of the continued waste oil spillage on the post and tried to control it through supply, fire, and command inspections. The problem was self-evident. Wherever vehicles were stored and maintained, there were oil spills on the ground. All the streams that drained from these areas were murky with oil slick and flowed into the once beautiful Potomac River. Storm drains showed definite evidence of oil dumpage. Even with strict control and continued inspections, the problem remained. To bring command emphasis to the magnitude of the situation, a physical waste oil survey was conducted for the Facilities Engineer.

The first item on the agenda was to get an accurate assessment of the total gallons of waste oil that contributed directly to pollution. This action had to be completed in order to fully identify the problem.

There were a number of probing questions that had to be explored and answered. What were the results? How large was the quantity of waste oil that was being generated? How much of this waste oil was not being accounted for through property disposal channels or commercial pick-up contracts?

A look at the petroleum supply catalog and the Petroleum Oil and Lubrication POL issue point at Fort Belvoir indicated that the engineer experts needed to consider all of the main lube oils separately.

Engineer personnel selected 41 Federal Stock Number items as indicative of the lube oils being used at Fort Belvoir. Then they made a composite list of all units stationed on the installation. The total lube oil issues for all of the on-post units were collected and tabulated. A one-year time span was used to determine a basis of issue. Also, a physical inventory was conducted to determine an accurate average of the usage of all oil that was being issued to the on-post units.

A tabulation of the oil issue revealed that about 33,000 gallons were being distributed per year. Waste oil turned into the Property Disposal Office (PDO) during the survey period was about 6,000 gallons. Also, some 9,000 gallons of waste oil was collected by commercial contract from major agencies on the installation. The total gallons of waste oil that was turned in still left about an 18,000 gallon differential. Allowing for minimal oil consumption in vehicles and pilferage of stock, it is estimated that about 17,000 gallons of waste oil accumulates on the grounds of the Fort Belvoir complex during a year's time.

To verify the amount of waste oil that was produced at Fort Belvoir, engineers tabulated the equipment density for all the units. Then they determined the oil capacities of each of the types of equipment. Proper maintenance services for each type of equipment was used as a yardstick to determine how much waste oil was being produced.

This type of action initiated by engineers at Fort Belvoir only identifies a portion of the problem of petroleum pollution. To make such information more complete and valuable, a questionnaire should be distributed to all pertinent units. The questionnaire could easily be expanded to include fuels and other pollution items. Thus, armed with information from both th consumer and the supplier, the study would becom more valid because it reflects a more realistic situatio

Here waste oil is collected from equipment that wa dumped down a storm drain.

The units should be given the opportunity to presen their problem areas in waste oil disposal. For example at Fort Belvoir it was noted not too long ago that wast oil could only be turned in to the PDO in a yellow stenciled, 55 gallon drum---a near impossibility. A goo part of regular issue lube oil is contained in smalle drums. A unit without access to the larger drum had th problem of how to turn in its waste oil. What could th unit do when it did not have the capacity to store th waste, nor the container with which to turn it in? Th PDO specified "yellow" drums but there was a scarcit of that color of paint. And there was still anothe factor. The PDO had considerable difficulty in sellin the containers of used oil to the commercial market.

All the aforementioned difficulties must definitely b considered as major factors that contributed to improper waste oil disposal at that installation. But ther also must be an understanding of the situation at bot command and unit levels to fully appreciate the problem. Improper waste disposal, it seems, is a breakdow of command emphasis on enforcement and a failure t provide the user with alternatives.

There were still other problems at Fort Belvoir. Military personnel were seen dumping waste oil from thei private automobiles in secluded areas of the post. Thi was noticed primarily at abandoned motor pool greas

Note the color of water and the erosion at this drainage point from two unit areas.

racks. In addition to an apparent lack of control of routine enforcement practices, this points up the simple fact that an individual need is not being met. A soldier needs a place to service his car just like anyone else. The unused racks could be moved to a central location to provide this need. This would eliminate another means of pollution and at the same time provide a needed service for the man in uniform.

Although this study at Fort Belvoir did not consider the outright spillage of fuel oil it confirms that thousands of gallons of waste oil is deposited on the grounds of that installation each year.

Of course, Fort Belvoir is only one of hundreds of military installations located around the globe. But they all have similar problems. The survey indicates that property disposal procedures are inadequate at Fort Belvoir. They have not been able to curtail the used oil portion of the pollution problem on that post. By identifying the problem in its true perspective, however, commands may be able to place specific emphasis in areas that would help eliminate the causes.

In light of this study, it would seem that the overall PDO practices should be re-evaluated and that procedures should be implemented to solve the waste oil problems of turn-in, storage, and collection. None of the using units---the PDO or the individuals involved---can selectively or collectively solve the problem. The solution to the problem and other situations that are detrimental to mankind must be initiated at the top of the chain of command. It is only up at the top of the ladder that the proper emphasis can be placed to eliminate the pollution situation.

For example, why shouldn't each oil using unit have its own oil storage tank for waste oil? If the post were to provide a tank and a pump with which to periodically drain the waste oil, the units would no longer have a storage and turn-in problem. The waste oil that would be removed from unit tanks could then be stored in a major tank elsewhere on the post or picked up by a commercial firm at a minimal cost (about two cents per gallon).

Pollution---whether it is waste oil, litter, black smoke from factories, eye-searing smog, musty waters of our rivers and lakes, or cigarette smoke---is an individual problem as well. All the guidelines in creation will not work unless someone does something about it. When the military commands begin to take notice that their own installations are causing pollution, as well as the factories, automobiles, sunken oil tankers, and garbage dumps, perhaps we will make some headway.

At any rate, we cannot leave the situation as it is today. Definite and positive steps must be taken now if we are to curtail the exorbitant future cleanup costs. With positive action, the chore of reclaiming and restoring polluted streams and lands to their natural state will be minimal.

Since the U.S. Army Corps of Engineers is responsible for policing the commercial firms, checking on the civilian polluting populace, and assuming overall responsibility for the future cleanliness of America, it would seem that it is time they cleaned up their own backyard.

The Army places primary responsibility for pollution abatement with the Deputy Chief of Staff for Logistics but the Corps of Engineers has advisory accountability in this matter. It is the Corps' duty to properly identify the sources of pollution.

Once our military installations are cleaned up, perhaps all the other efforts that are made will be fully justified. And after every backyard is clean and we can all drink clean water and gratefully nourish the clean air in our lungs, perhaps then the kids will take their signs and go home saying, "Well, whadd'ya know? They listened! The generation gap is beginning to close at last!" ⊖

Captain Lawrence A. Willwerth, currently assigned to the 1170 Port Detachment in Boston Massachusetts, graduated from the Engineer Officer Advanced Course at Fort Belvoir, Virginia, with Class 1/72. His article is part of an extensive staff study he submitted to The Engineer School to both accommodate an academic requirement and to address an installation problem area.

THE THIRD POLLUTION

Major William B. Willard, Jr.

Rachel Carson once wrote, "In biological history, no living organism has survived long if its environment became someway unfit for it, but no organism before man has deliberately polluted its own environment." Today, man's factories and automobiles belch clouds of contaminents into the air; his sewage flows untreated into lakes and streams; and his refuse is strewn along the highways or lies rotting in open dumps.

The planet earth has only three waste repositories---air, water and land. They also are reservoirs for all the essential life resources we possess. Man's habit has been to think of them as limitless. But at the rate the world's human population is growing we can begin to view with real concern the fact that the earth has no more air, water or land today than when man first began to generate wastes. Keep in mind that these reservoirs are interconnected and to pollute one may mean to pollute the other two.

The population of the United States has recently exceeded 200 million, and based on current growth rates is expected to reach 400 million by the year 2000. Refuse created by each man, woman and child in America now approximates five pounds per person per day, and as our affluence increases so will the production of refuse.

Coinciding with the highest standard of living in the world, our nation also produces the largest volume of solid waste. With every purchased commodity item wrapped in cellophane or encased in plastic, the simple act of disposing of these protective wrappers is creating a major problem. Plastic packaging is almost immune to biological decomposition. If plastic packages are buried, they remain almost indefinitely in their original state. If they are burned, they contribute hydrocarbons and oxides of nitrogen to our atmosphere.

Plastic wrappers, however, are really a negligible portion of the total solid waste problem, but serve to demonstrate some of the difficulties associated with ultimate disposal. By definition, solid waste includes all waste products of man, excluding body wastes.

Solid waste examples are food wastes or garbage; rubbish, including such items as discarded paper products, wood, bedding, metals, tin cans, crockery, glass and clothing; ashes and dirt; dead cats and dogs; sweepings and leaves, and abandoned cars and trucks; food processing wastes, lumber and metal scraps. Also cinders from factories and plants; such residues as lumber, masonry, metals, paints, and concrete from demolition and new construction projects; radioactive materials, explosives and pathological wastes from hotels, institutions, stores and industries.

The solid waste list is almost infinite. However, it serves to emphasize the fact that our cities, towns, and villages and great industrial complexes are producing a wide variety of solid waste that eventually must be disposed of in some manner. No longer can refuse be hauled to the edge of the city limits and dumped. It must be disposed of in a safe, sanitary and economic manner. Perhaps history will someday portray America as the nation which put man on the moon while standing knee-deep in its own refuse. Proof that lives can be lost because of the mismanagement of solid waste disposal methods made worldwide headlines several years ago when some 200 lives, mostly children, were lost in a coal slag avalanche at Aberfan, Wales.

Lack of concern and education on the part of the public is the primary reason solid waste disposal has become a threat to America's future. The city dweller becomes concerned only when his garbage is not removed. This point can best be demonstrated by the experience in the late 1960's when the garbage collectors of New York City went on strike. Mountains of garbage accumulated on the streets and provided a haven for rates, mice, and flies which created a serious health hazard. New Yorkers lived with the stench of rotting garbage for only a relatively short period of time, but from their brief discomfort came the realization that solid waste disposal should be of concern to every citizen.

Apparently, this lack of concern is not universal, for the Federal government reports that today less than half of the cities and towns in the U.S. with populations of more than 2,500 dispose of community refuse by approved sanitary and nuisance-free methods.

Not only is America's natural beauty being blighted, but health hazards exist everywhere in the form of open dumps, littered streets and highways, smoke from backyard incinerators, and discarded waste from industrial plants. Solid waste disposal is expensive. Federal statistics demonstrate that it is costing the American taxpayer over $1.5-billion for disposal services—exceeding only expenditures for schools and roads in its magnitude. Yet the existing disposal services are inefficient. There are too many cases of unnecessary bickering between municipal governments resulting in duplication of refuse disposal efforts. Solid waste pollution recognizes no political boundaries and should be treated accordingly. Cooperation between state and local governments is a necessity if the solid wastes pollution problem is to be solved.

By the present "thinking" of environmental engineers, solid waste or refuse is handled in three phases ---the storage phase, the collection phase, and the disposal phase. Initially refuse is created by the taxpayer and is temporarily stored in an indoor and then an outdoor container---first the wastebasket and then the trash can. The degree of refuse separation is dictated by the collection agency, which may specify no refuse separation or separation into garbage, rubbish and ashes.

Normally, all storage costs are paid by the household occupants. During the collection phase the municipality provides the necessary personnel and equipment needed to pick up the refuse, usually twice weekly, and the expenses are paid from the city's operating funds. If municipal pick-up is not provided, the scavenger service normally is used, with the resulting inability to meet and control sanitary standards. Lastly the refuse is discarded. Generally it is conceded that through mismanagement during the disposal phase, solid waste causes the most damage to the environment.

There are a number of accepted methods currently practiced in the United States which are recommended for refuse disposal. These include:

- Incineration
- Composting
- Sanitary Land Filling
- Dumping
- Hog Feeding
- Discharge to Sewers

Incineration. This is an expensive means of refuse disposal, but in municipal and urban areas where refuse production exceeds 100 tons per day, this method may be economically feasible. It has been found that incinerators are high in initial cost---usually from $3,500 to $5,000 per ton---to build and equip, based on a rated 24-hour plant capacity. Afterwards, incinerator operating and maintenance costs should vary from $3 to $7.50 per ton for refuse. Perhaps the main advantage of incineration is the fact that a central location can be used, thereby minimizing haul distances during the collection phase. Incineration also permits flexibility of operation, and may provide a source of income through the sale of waste heat for steam or power. Keep in mind, however, that incineration merely transfers solid waste problems to an air pollution problem. Even the most modern incinerators contribute air contaminants in the form of particulates, hydrocarbons, oxides of nitrogen and carbon-monoxide to the atmosphere and, at best, may be able to achieve a 90 percent reduction in solid waste. The remaining fly ash still must be collected and disposed of by some other means.

Composting. This is a method of refuse disposal that has had considerable success in many European nations. The process is recognized as one of waste recovery, for composted refuse serves as an excellent organic additive for agricultural soils. In some countries it is actually responsible for producing sizeable municipal revenues. Because of the availability of cheap fertilizers in this country, however, a widespread demand for compost has not yet materialized. Until recently, Johnson City, Tennessee, was the only municipality in the United States to practice composting.

The composting process is basically a biological process in which aerobic bacteria reduce shredded and blended organic matter into a stable end product over a three-week period. Initially, inorganic materials such as cans and other metals and glass are removed by either a mechanical or manual process, and subsequently may be sold for reclamation purposes. The remaining organic matter such as food wastes, wood and paper products are shredded to increase the surface area for bacterial action and blended to achieve an optimum carbon-nitrogen ratio of approximately 35:1 for maximum aerobic bacterial growth. Organic matter deficient in nitrogen---like paper---can be combined with other wastes high in nitrogen, such as fish scraps or sewage sludge. Composting can serve not only as a means of waste recovery, but also as a means of alleviating a special growing form of solid waste pollution---sewage sludge. The possibility of recovering valuable material from the huge volumes of municipal refuse appeals to the imagination. As economic conditions change and technology improves, perhaps the composting process may gain wider use in the United States as a form of waste reclamation and as a solution to the total solid waste pollution problem.

Sanitary Landfilling. Of all methods of refuse disposal, sanitary landfilling is the most widely used. It is the most economical method where land is available and is an excellent means of converting useless real estate into valuable property. The following extract from Henry Still's documentary, "The Dirty Animal," is a dramatic example.

"Henry Soto is a Los Angeles landscape architect who drove several miles each day to his office, and each day passed a forty-foot deep abandoned gravel pit. Then came the bright idea. Soto rounded up several partners, purchased the pit, and converted it into a private garbage and trash dump. The combine charged trash haulers $8.00 per truckload to use the dump---a low price in the Los Angeles area---and covered each day's collection with a layer of earth, according to approved sanitary landfill practices. Soto also set out a living fence to screen the dump from the highway, and planted a border with flower beds and trees. The area was so attractive that new customers became confused and drove on by until Soto put up a sign which read 'Disposal Gardens.' When the hole is filled, Soto plans to build a swimming pool and tennis courts on the new level ground, and then charge admission to his private recreation area." Mr. Soto is just one of thousands who has used his imagination and initiative in employing the sanitary landfill as a profitable and safe method of refuse disposal.

Another widely publicized example is the approach which the municipality of Virginia Beach, Virginia, took in solving the solid waste problem. Using the sanitary landfill method, the community's trash was used to construct a hill some 80 feet high. On one side an amphitheater has been built, while the other side has been reserved for skiing. The hole from which cover material has been excavated is to be converted to a fresh water lake. Subsequently, the project has been named "Mount Trashmore."

Dumping. This is another method of solid waste disposal, but it has limited applications. Some components of refuse are suitable for open dumping. These include street sweepings, ashes and residue from incineration processes. Serious nuisances and health hazards, however, can develop if garbage or mixed refuse is disposed of in this manner. Dumping is frequently used to reclaim low areas and may permit the construction of a fairly stable fill. Dump locations must be carefully chosen so there will be a minimum chance of complaint from nearby residents.

Hog Feeding. Feeding garbage to hogs has been practical for many years. Some cities formerly operated hog farms, but municipal piggeries at present are few or non-existent. It is estimated, however, that about 25 percent of the total quantity of garbage produced in this country is fed to hogs by private individuals. That garbage feeding is profitable when properly handled is shown by the fact that most hotels and restaurants can dispose of their garbage to farmers who are willing to collect it themselves. Usually they collect daily and furnish clean cans. While garbage is the most potentially valuable element of refuse, it is the most difficult to handle in a sanitary manner and is responsible for the majority of nuisances and health hazards associated with the management of solid waste. Health authorities recognize the danger of contracting trichinosis from the consumption of improperly cooked pork products. Hog feeding, like other methods of garbage utilization, still involves the necessity of providing for the proper disposal of other refuse.

Discharging to Sewers. Three methods for the disposal of garbage with sewage are in use in the United States---the installation of individual grinders in homes and commercial establishments, the installation of municipally-operated, centrally located grinding stations, and the installation of grinders at sewage treatment plants. All three subsequently discharge waste into raw sewage lines. Household grinders have been found to contribute no major difficulties to sewage collection systems. At the sewage treatment plant, the load of solids can be expected to increase from 0.07 to 0.10 pounds per person on the dry basis. A few cities have forbidden grinders, and this restriction is justified where existing sewerage facilities are overloaded. Universal adoption of household grinders will be necessary if the process is to have a material effect upon the solid waste problem. The total volume of refuse would not be substantially reduced because garbage constitutes only 10 to 15 percent of the refuse in many cities. A major advantage of discharge to sewers, however, is that by eliminating garbage from the storage phase, the frequency of collection can be reduced by at least 50 percent. Jasper, Indiana, became the first community in this country to attempt city-wide installation of grinders. Results so far have been favorable.

The location of central grinding stations at convenient points along the sewer system or at the sewage treatment plant is favored in some cities. Both of these methods require initial separation of the garbage from the other refuse by the householder, necessitating an additional municipal pick-up. Ground garbage is then introduced directly into the sewage treatment plant. There have been no reports to date that the discharge of ground garbage into the sewer system has caused any trouble. However, an increase of cockroaches and rats has been noted in some trunk sewers. It has been found that if garbage of all population contributing sewage is ground at a central grinding plant and then discharged into the sewers, the suspended solids may be increased approximately 50 percent, and the biochemical oxygen demand may be increased 30 percent. To accommodate this increased loading, the existing sewage treatment facilities must either have been constructed with a capability of operating at expanded capacities or must possess the capability of being modified structurally. If not, it will result in non-satisfactory sewage treatment.

In taking the first action to control solid waste pollution, authorities should no longer permit open dumping, unsightly automobile graveyards, feeding uncooked garbage to hogs, strewing litter along the highways, dumping refuse at sea and other bad refuse disposal habits. These violations should be prohibited by law, and such laws strictly enforced.

On January 4, 1965, in his State of the Union message, President Johnson said, "I propose that we increase the beauty of America and end the poisoning of our rivers and the air that we breathe." In October of the same year, he signed into law the Solid Waste Disposal Act. This legislation, for the first time in the nation's history, gives responsibility to the Federal Government for developing new methods of solid waste disposal. Emphasis is to be placed upon "conservation of natural resources by reducing the amount of wastes and unsalvageable materials and by recovery and utilization of potential resources in solid waste." Additionally, the act provides for "technical and financial assistance to state and local governments and interstate agencies in the planning, development, and conduct of solid waste disposal programs."

Since its passage, science, technology and the government are moving toward a solution to the solid waste pollution problem. The Congress has authorized the appropriation of more than $100-million for this area of concern.

A number of universities have received grants to support graduate student training in the field of solid waste. The Surgeon General of the Public Health Service has established the Office of Solid Wastes. This subsequently started a great number of research programs and demonstrations. Also, the recently created Environmental Protection Agency is developing standards governing solid waste management.

America in now on the "move" to meet the challenge of solid waste pollution. Public concern has been aroused over the degradation of the environment. Now, all across the country, individuals, ecology groups and civic action organizations are combining to "clean-up" the face of America. Numerous recycling centers have been established to serve as focal points for the collection and ultimate re-use of such items as newspapers, bottles and aluminum cans.

Fort Belvoir, Virginia, the "Home of the U.S. Army Engineers," is no exception to the collection plan. Captain Theodore J. Trauner, a student in the 1st Engineer Officer Advanced Course, Fiscal Year 1972, has initiated a trial project with the help of his classmates. Salvable items are deposited by the residents of Fairfax Village in 15 appropriately marked trash cans that are stored in front of the Captain's quarters. Magazines with glossy print are not acceptable for recycling, and all cans must be flattened. To take care of this latter chore, Captain Trauner is relying upon the services of the Boy Scouts. Periodically, the trash cans which have been made available by the Directorate of Facilities are emptied and transported by private haul assets to a commercial recycling center. Revenues in the amount of 30 cents per 100 pounds of newspapers and 8 cents per pound of aluminum cans are the reward. If this concept of solid waste disposal proves successful in Fairfax Village, then it is hoped that plans will be activated to provide a post-wide service. Perhaps salvaging may prove to be an effective means of reducing the Facilities Engineer's operating costs at Fort Belvoir.

New ideas and innovations are required to solve the solid waste pollution problem. As America moves into the decade of the seventies, it seems destined to come to grips with the harsh realities of uncontrolled environmental degradation. Unless the trend of years of environmental neglect is reversed, man may find too late that the ecological balance of nature has been irreversibly altered.

Major William R. Willard, Jr., presently is assigned as a staff officer with Headquarters, European Command (J-4). He formerly taught environmental engineering at the U.S. Army Engineer School, For Belvoir, Virginia. Originally an Infantry officer, he served in Vietnam as a commander of C Company, 19th Engineer Battalion (Combat) and later as Assistant S–3 of the 937th Engineer Group (Combat).

DYNAMIC

TIPS FROM THE FIELD

Lieutenant Colonel George W. Page

As has been previously stated, Dynamic Training is nothing more than a new approach to an old problem. The underlying philosophy is to revitalize unit training ---to eliminate the apathy which frequently results when training is routinely conducted to comply with relatively rigid requirements imposed by higher echelons of command.

Brigadier General Gordon Peltier, Commanding General, 16th Engineer Brigade (Combat), Ohio National Guard, submitted the following example of Dynamic Training which involved the 16th Brigade's 612th Engineer Battalion.

The 612th, having been recently converted from an armored cavalry squadron, actively sought suitable engineer troop projects to provide effective dynamic basic unit training during its short summer training period. The battalion was given the project of designing and constructing an abandoned township road in the Fallsville Wildlife Area of Southwestern Ohio during its active duty training period, July 11–23, 1971. The State of Ohio requested the assistance to provide access into an otherwise inaccessible part of the wildlife area and furnished the engineer construction materials and bivouac area. The 1,700-foot roadway traversed a

TRAINING

heavily wooded tract of land through which several streams flowed.

Completion of the project required the employment of many combat engineer unit capabilities and skills, such as surveying, land clearing, sub-base, base course and wearing surface (crushed rock) construction, design and construction of two Class 30 timber trestle bridges and several large culverts. Also required was the installation of lateral drainage facilities that included ditches with checkdams to reduce erosion.

The project was divided into two company-sized projects of approximately equal size and scope. Companies A and C of the 612th Engineer Battalion were assigned the projects for construction. Spurred on by a healthy competitive spirit to produce the highest quality product and to maintain the production schedule, Companies A and C of the 612th displayed an esprit-de-corps among their personnel which contributed greatly to the value of the unit training derived from the project, and assured completion right on time.

Obviously proud of their accomplishment, many of the Battalion's personnel visit the wildlife area with their families for recreation, and point out the permanent credit signs which the state installed along the completed road in recognition of the unit's efforts during the two-week training period in July 1971.

This project demonstrated to a great extent many of the capabilities and the versatility of a combat engineer unit, and served to develop individual personnel skills. The value of practical "hands-on" training, as used in this particular instance, when compared to a classroom environment of lectures and conferences becomes readily apparent. This technique of instruction provides a much more effective vehicle for speeding the technical proficiency of combat engineer unit personnel.

Favorable publicity and recognition by state and local authorities fostered a public awareness of the positive value of the National Guard Engineer Battalion which, in turn, did much to promote the unit's esprit-de-corps. For its efforts during this training period, a First Army evaluation team recommended that the 612th be designated an "Outstanding Unit," a coveted award.

Dynamic Training, of course, may be accomplished in many ways. One of the better examples of it is the manner in which land navigation is taught—by Orienteering.

In its simplest form, Orienteering may be defined as a timed cross-country map course. It began primarily as a military training method in Scandinavia during the late 1800's to renew the interest of Swedish youth in track and field events.

The first competition consisted of a combination of cross-country running and map course over unknown terrain and was held March 25, 1919. It proved to be a great success. The Orienteering program spread rapidly throughout Europe, and by the late 1950's many international events were being held on the continent. In 1965, a U.S. Army Special Forces group stationed in Germany represented the United States for the first time in Orienteering competition during a meet sponsored by the Conseil International du Sport Militaire (CISM).

Orienteering was first used as a military training vehicle in the United States at the U.S. Marine Corps Physical Fitness Academy and the U.S. Military Academy in 1967. It was added to the Programs of Instruction at the U.S. Army Engineer School, Fort Belvoir, Virginia, in February, 1970, and at the U.S. Army Infantry School, Fort Benning, Georgia, in November of that year. Currently, it is taught at the Engineer School to Officers and Noncommissioned Officers attending the three resident professional development courses.

The Orienteering Program rates quite high as an individual and military unit training technique. The combination of the practical use of maps, compass techniques, terrain orientation, physical fitness, mental alertness, determination, and decisiveness makes every orienteering hour valuable to the participant.

Essentially, the rules applicable to orienteering are relatively simple, and the equipment required is minimal and inexpensive.

At the outset, the competitor reports to the starting line where he is issued a map, clue card and score card. When given the signal by the timer, he consults a master map from which he learns the control points he must visit as he runs the course. At each of these his scoreboard is marked in a manner identifiable only to that particular station. Speed is the all-important factor in the competition, for running the course is a race against time.

There are three types of orienteering courses. In Freestyle orienteering, the competitor runs to all points but may choose his own route to each of the stations. Line orienteering, on the other hand, is similar to a compass course and participants must follow a pre-determined route to the control points. Score orienteering provides several options for the competitor. In this type of course, a number of stations are marked on the map and assigned point values based on the difficulty involved in reaching it. The time limit established for the course usually precludes a participant from reaching all stations. He must then decide which stations to attack and in what sequence. The objective of score orienteering is to acquire the maximum number of points within the time allotted, and if that time is exceeded the competitor is penalized. One tactic used in this course is to run the perimeter stations until time becomes critical then move toward the finish.

Five techniques are used in orienteering---Route Selection, Aiming Off, Attacking Known Points, Collecting Features and Judging Distance.

Route Selection means just that. The competitor must choose between a short, difficult but direct route, or select a longer, easier route to his objective.

Aiming Off involves running to a station located along a stream or road, and purposely taking a route which will assure the competitor that he is off to one side of the station so that he is positive of which way to turn to find it.

When a participant employs the technique of Attacking Known Points, he selects prominent physical or terrain features which he knows from having located such features on the master map are located in the near vicinity of the station being sought, and moves directly to the site.

Judging Distance is the determination of one's pace for 100 meters when using different strides and traversing varying kinds of terrain.

Orienteering as a military training program is quite effective and highly recommended. No elaborate or expensive individual equipment is required---topographic maps, compasses, locally produced clue cards of the stations to be visited and score cards which the competitor marks at each station on the course comprises the complete list. Unit personnel needed to officiate include two each to function as timers, scorekeepers, aidmen and range controllers.

The U.S. Army Engineer School has prepared an Orienteering Instructor's Handbook designed to help interested personnel in setting up and administering this type of training within their own units. It can be obtained by writing the Director, Department of Applied Engineering, U.S. Army Engineer School, Fort Belvoir, Virginia 22060.

Additional information on orienteering may be found in "Be Expert with Map and Compass," by Bjorn, Stackpole Company, Cameron and Kelkenstret, Harrisburg, Pa. 17105, 1967; "Orienteering," by John Disley, Stackpole Books, Harrisburg, Pa. 17105, 1967; and "Orienteering and Aid to Training," by J. R. Chapman, Hillside Printing Company, 230 Woodhouse Road, Finchley, London N. 12, England.

How about you? Have you led or been involved in any particularly interesting and effective training excercises? The Engineer Dynamic Training Council is interested in hearing about what you have done. This department of "The Engineer" will regularly feature ideas that have been submitted. We need your support. So please send a brief account of your training experiences and/or you ideas to: The Engineer Dynamic Training Council, U.S. Army Engineer School, Fort Belvoir, Virginia 22060. e

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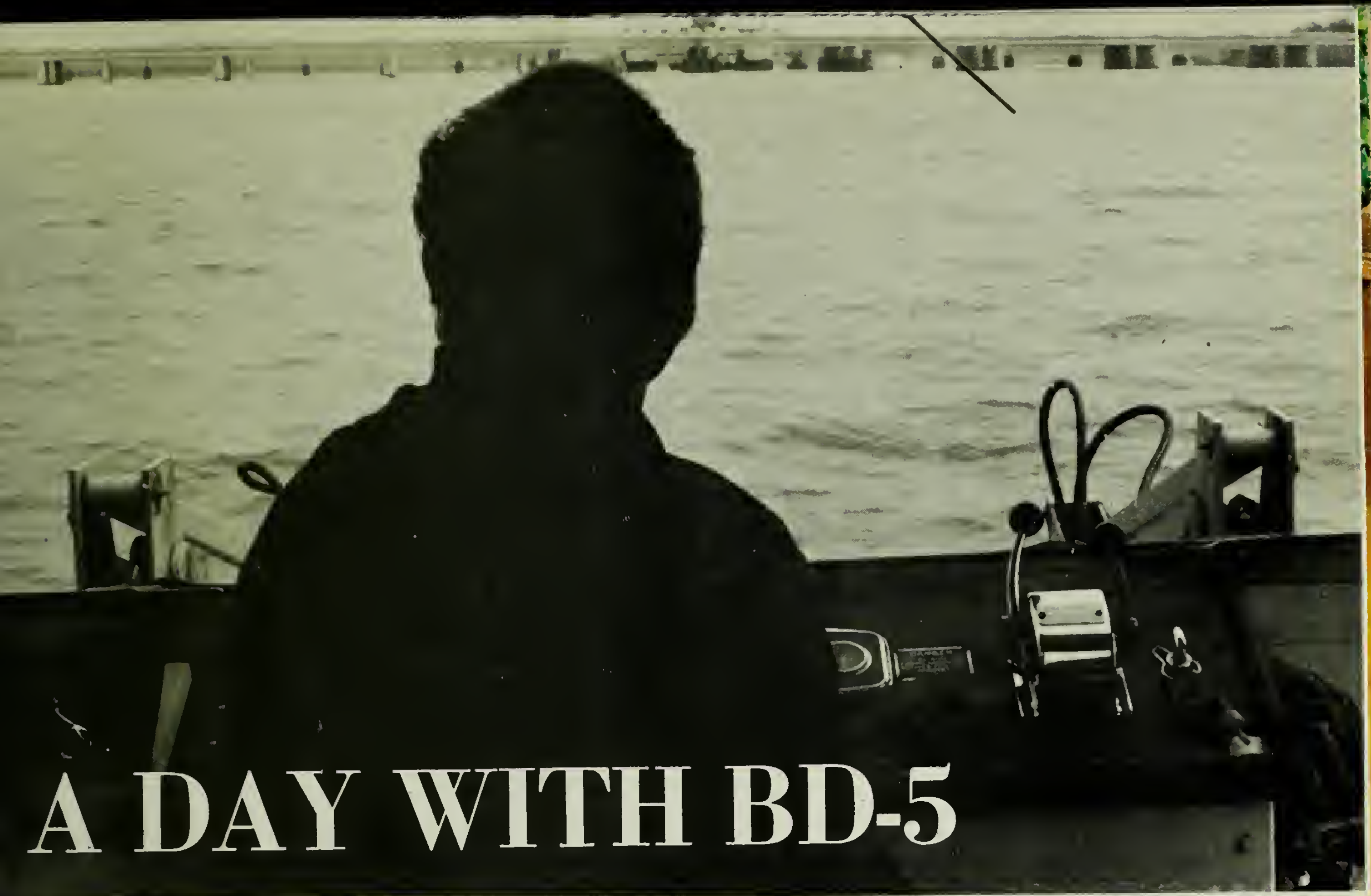
Lieutenant Colonel George W. Page currently is Director, Department of Applied Engineering at the U.S. Army Engineer School, and also functions as the Deputy Chairman of the Engineer Dynamic Training Council. His assignments have included duty with the 116th Engineer Group (Combat); 542d Engineer Company (Geodetic Survey); Los Angeles Engineer District; IV Corps Advisory Headquarters and Construction Directorate, Headquarters MACV, Republic of Vietnam; Headquarters Central Army Group; and Commanding Officer, 10th Engineer Combat Battalion, 3d Infantry Division in Germany. He is a graduate of the United States Military Academy, the Command and General Staff College, and the British Staff College. He holds a Master's Degree in Civil Engineering from the University of California.



A DAY WITH BD-5

It was just another routine day for the two-man crew of BD-5.

Frank E. Hart, who captains the little 30-foot drift collector, and his crewman, John J. Coley, launched their craft about 7 am from its mooring alongside the Washington Navy Yard dock for another bout with the muddy Potomac.

Their mission is simple and they know it by heart. They do it every day, rain or shine, sleet or snow. They have been sweeping the Potomac and Anacostia Rivers, the Washington Channel, and the Tidal Basin to clean up navigational obstacles since 1966.

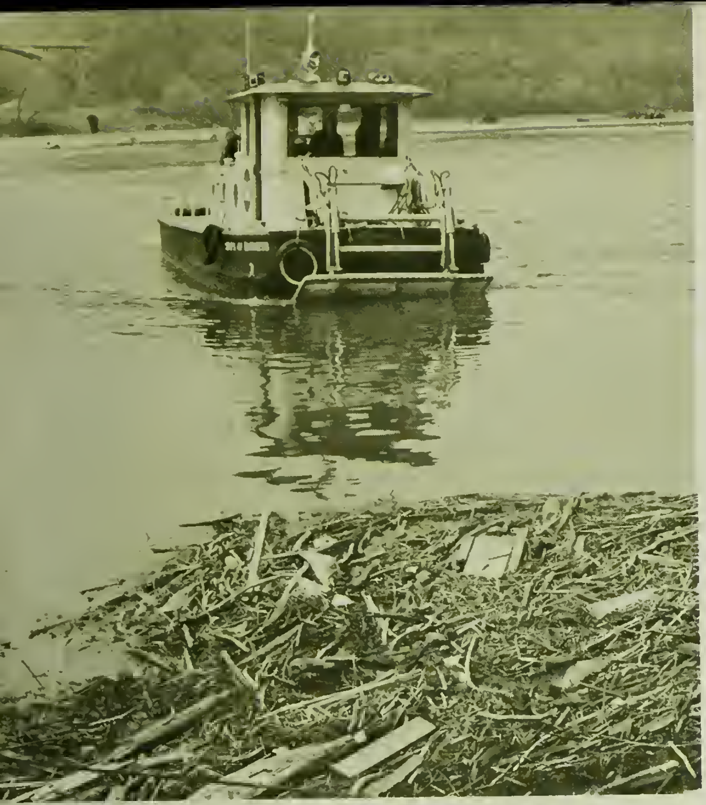
Hart and Coley are two members of an eight-man Drift Removal Unit that works out of the Baltimore District Navigation Branch of the Corps of Engineers.

The professional crew operates under the direction of Harry Moran, a veteran of 31 years with the Army Corps of Engineers. They get the job done with two 30-foot craft equipped with wire mesh, scoop-type baskets, one 35-footer equipped with an A Frame, one 80-foot crane barge, two 40-foot open deck barges, and a 20-ton crane.

On this clear, bright day, Hart headed BD-5 up the polluted Potomac toward the Three Sisters Bridge site above Georgetown. The tiny craft chugged slowly toward its destination pushing a scow ahead of it.

BD-5
CORPS OF ENGINEERS

US ARMY
CORPS OF ENGINEERS
CORPS OF ENGINEERS



They tied the scow up to an old abandoned boat that was docked against some pilings at a construction site within eyesight of the skeleton of Three Sisters. Then Hart began to make a methodical sweep of the river around the pilings, near the shore, and further up around the piers of the bridge that may never be completed.

Hart and Coley have a number of ways they can collect the debris. They can get it with the basket which scoops and elevates. They can get large pieces that are too close to the shore for BD-5's basket to scoop up by snagging it with a nylon line, then pulling it out to deeper water where the basket can do the job. They also go ashore as far up as the high water mark and pick up debris with their hands. The craft equipped with the A Frame is used for the real large pieces.

The debris, of course, is loaded onto the scow each time the basket is full. There was plenty of driftwood this day and the scow was full by about 2:30 pm. So Hart headed for home with his load.

Coley pointed out that they sometimes find dead horses, cows, deer, dogs, cats, rats, men, women, and children in the water. They call for a District of Columbia police boat when a body is found. There was only a dead dog this day and it went downstream faster than BD-5.

With their radio dispatch phone tuned in, Hart and Coley are subject to emergency calls from the Coast Guard, the D.C. Metropolitan Police, the U.S. Navy, and all private boat owners.

These craft are keeping 30 miles of Washington's waterways and shoreline free of debris and are helping make the environment picture look a little brighter. Hart said they sweep the river before each President's Cup Regatta is held. Also, they try to keep it as clean as possible so pleasure craft can let the throttle out.

BD-5 finally pushed the scow up to the barge at the Navy Yard and tied up. The crane would take the debris from there, lifting it off and into a 40-cubic-yard portable bin. Its final destination was a landfill at Wayson's Corner. Some 15 million pounds of effluvia has gone into that landfill since the project began six short years ago.

What did the two-man crew of BD-5 accomplish on this day? They traveled about 30 nautical miles from the time they started out in the early morning until they docked at 3:30 in the afternoon. They also collected about 25,000 pounds of debris, mostly driftwood. Was this a big day? No. Hart and Coley both agreed that it was just average---routine.

ENGINEER STAFF

Planning A Dynamic Training Program

Colonel W. R. Hylander, Jr.

Dynamic Training is catching on more and more, according to our Engineer Dynamic Training Council surveys and the feedback reaching the Engineer School. Elsewhere in this issue you'll find more "Tips From the Field" on ways other engineers have made their training more interesting and effective.

There are some misconceptions about dynamic training, however, that should be erased. Too many engineer trainers are thinking of it only in terms of occasional stunts to be employed when things are dull, or perhaps when the subject is particularly appropriate for an "adventure." Dynamic training includes that, to be sure, but what happens on the days or weeks in between "adventures?" Do you have to carry on with old-style "non-dynamic" training, while the lieutenant works up another idea and persuades the old man to let him try it out?

No, you don't.

A unit can make its entire training program dynamic. It's not hard to do. Here at the Engineer School, we have developed a prototype that may become an official Army Training Program (ATP) for engineer combat battalions. That will take some time. Meanwhile, there is nothing to prevent your unit from developing its own. Several battalions have already begun. Former Army Chief of Staff, General William C. Westmoreland, pointed out in a June 30, 1971 message to the field that your unit commander has the flexibility to do so. All it takes is some planning.

Unit training programs are prepared on an annual basis, and usually culminate in a test which should measure the unit's capability to perform its combat mission. Called an ATT (Army Training Test) or an ORTT (Operational Readiness Training Test), these tests too often turn out to be three-to-five day convoy and bivouac drills for the troops, while the commanders and their staffs handle engineer projects by paperwork. Rarely are squads and platoons required to physically demonstrate their proficiency in the myriad tasks engineers should be able to do in combat, because ATTs or ORTTs are not prescribed below battalion or separate company level. Despite the sincere efforts of evaluating umpires, many such tests are basically phoney.

The fault lies with the Army's system for training and testing of units. Developed during World War II when all types of units had to be activated, trained, tested, and shipped overseas in the minimum time, the Army's family of ATPs and ATTs is basically sound. For the cyclic annual training of active Army units or those in the reserve components, the system is poor. Get the ATP and ATT from your unit's files and read them critically. Then ask yourself how much help they really provide in your situation. The ATP is little more than a check list of subjects and references. It is merely a guide, but too often it becomes a straitjacket because of readiness reporting requirements. Units must be tested somehow and the system doesn't allow any other way. Here I'm really indulging in self-criticism, for my department of the Engineer School is responsible for writing the ATPs and ATTs for all engineer units. Through the years, however, their style and format and content have conformed to the "system." There has been little criticism of the documents and there was always the proviso that they could be "adapted to local conditions."

Looking for something of more value to modern unit training, we began studying ways to improve the system in 1970. Drawing on our own training experiences, on limited reports from units, and then on the results of our dynamic training survey, we drafted ATP 5–35T (T = Test), for the Engineer Combat Battalion, Army or Corps. Although it was still in draft form, the concept drew favorable responses from the Engineer Center Team and the Combat Arms Training Board. And in March 1972 it was presented to the Chief of Staff's Forum for Center Commanders at Fort Sill, Oklahoma. It now has all the informal support and encouragement we can use from people like General Ralph E. Haines, Jr., CG,CONARC; Lieutenant General Harris W. Hollis, Chief of Reserve Components; Lieutenant General George I. Forsythe, Special Assistant to the Chief of Staff for the Modern Volunteer Army; Major General LaVern E. Weber, Director of Army National Guard, and General Westmoreland. The latter commented, "This sounds like fun for the officers and the troops," and held our engineer proposal up as a model that other branches could follow. So you commanders who want to try out the concept need not worry about support from the top. You officially have the freedom and flexibility to do so. If you think you need assistance, contact us at The Engineer School.

The key features of this dynamic training program for an engineer unit are—

- No mandatory hours of training are prescribed. It is up to each commander how much time he devotes to any subject.
- Training objectives are tied to manning levels. At reduced manning levels, only company, platoon, or squad training objectives need to be achieved.
- Testing requirements are specified for each element from squad through battalion.
- Testing is spread throughout the training cycle instead of being concentrated into a three-to-five day period at the end of the cycle.
- Tasks to be tested are designed for two-day accomplishment.
- Achievements are to be evaluated, and validated, within the chain of command, and two levels higher. In other words, the battalion commander validates what his platoons do, and the battalion is validated by the engineer brigade commander or his equivalent. For Reserve or National Guard units, the validator is a Reserve or National Guard officer.

The training cycle varies in length. A newly activated unit that is training full time during wartime mobilization needs about 33 weeks. An active Army unit should follow an annual cycle while a reserve component unit should follow a three-year cycle.

The training program should be designed around a series of tasks, each designed for a two-day block of training. For Reserve and National Guard units, this would fit a weekend multiple drill period at home stations. For active Army units, one 2-day period is about all that should be planned for pure training, considering the normal commitments for guard, housekeeping, maintenance, ash and trash details, and other requirements. For units newly activated under wartime mobilization and operating on a 48-hour week, two 2-day blocks could be accomplished each week. In each case, the time not scheduled for dynamic training is available for commander's time, for details, and for any preliminary instruction the unit leader thinks his men need before undergoing evaluation for real. Each two-day block, is not just exposure to instruction; it is an evaluated demonstration of the unit's ability to perform its combat mission.

A combat engineer squad should be capable of some 76 different tasks that are listed in ATP 5–35T. Several could be combined to make up a two-day training block. For example, a squad might be required to execute a 40-kilometer engineer reconnaissance on foot. Then it might be required to take an overnight bivouac and turn in oral and written reports upon its return. Don't look over its shoulder all the way. Give that squad the mission and turn it loose. Inspect it once enroute and upon its return, and evaluate its reports. You'll identify the true squad leaders, and you'll help them develop leadership and to fashion their squads into teams.

You can give companion and competing tasks to two elements. For example, have two platoons set up dug-in and camouflaged platoon positions, including a real bunker; then have them switch attack, and clear and level the other's site. There are some 36 different tasks a combat engineer platoon should be able to do.

A typical company task might be a Bailey bridge. Don't just specify so many hours of bridge training. Give the company a mission of crossing a tank or an equivalent load over a designated gap at night. Make the bridge material and the tank available. Give them the first day to prepare, the night to do the job, and the second day to tear it down. If the tank crosses on time, the company passes its test. Every man will see it and know it, and the result will be associated with team work.

The secret of unit training is teamwork. Sometimes an oustanding leader can make even an unskilled crew look good. Sometimes a good crew can even make an incompetent leader look good. But the goal should be to develop both competent leaders and motivated, skilled crews, and to evaluate them as a team. Tasks should be designed to be measured on a go/no-go basis wherever possible, so that every man knows the mission and can see the results. Getting the tank over the bridge is an ideal example. The use of detailed check lists and point-scoring techniques should be avoided as this often degenerates into subjective judgment and becomes a farce that fools no one. If the unit is too noisy at night or has poor light discipline or security, give it remedial training—don't flunk it on bridge-building!

Some of the evaluated tasks should be construction projects. These can be of almost any sort, but they should be evaluated from an engineering standpoint. If possible, incorporate quality control. It's hopeless to pack enough such tasks for every squad, platoon, and company into a battalion ATT. You need to spread them out through the training cycle. With a little initiative and some planning, enough projects can be created. These could be on-post and even under simulated tactical conditions, or they could be off-post for organizations such as the Boy Scouts. If it relates to the unit mission and if it's done for real, evaluate the units performance and validate it for credit.

For a combat engineer unit, about half of the two-day tasks should involve night operations or an overnight bivouac. When the unit is in the field it should be tactical—camouflaged, dug in as appropriate, employing security elements.

Training should be progressive from squad to platoon to company and then battalion. There can be some overlap, since a company can be evaluated while its platoons and squads are engaged in tasks that are also being evaluated. The battalion commander and his staff can best be evaluated when the whole unit is in the field, as in the current ATT period. The difference is that only he and his staff are undergoing evaluation. Subordinate elements can be given makeup training, assigned projects or be retested on subjects they missed or failed.

It is estimated that an active Army engineer unit under such a training program would need to schedule two-day training blocks during only about 27 weeks per year, coupled with a period of two to three weeks when the entire battalion would live and operate in the field. A reserve component unit, on a three year cycle, would require about half of its multiple drill periods for training, and about half of its two-week summer camp periods. Validations, when achieved, would remain valid for 12 months for Active Army units and for 36 months for a reserve component unit.

These are the highlights of the concept for a dynamic training program for engineer units that the Engineer School has proposed for Department of the Army adoption. As pointed out earlier, however, you don't have to wait for it to be adopted. If a unit commander wants to modify it now to his training needs, he has support and encouragement from the Chief of Staff on down. If help is needed in developing your training program, we at the Engineer School will do our best to assist you.

Dynamic training isn't just an occasional adventure for a squad or a platoon. You don't have to wait for the right opportunity to come along. You can plan an entire program of dynamic training, and you can do it now. Some units have already launched their programs. How about you? ⊖

Colonel Walter R. Hylander, Jr., Director of Doctrine and Training Development at the Engineer School and Chairman of the Engineer Dynamic Training Council, maintains he has trained dynamically the 1st, 2nd, 3rd, 138, and 288th Engineer Combat Battalions; the 487th Aviation Engineer Battalion (USAR), and at the Republic of Vietnam Armed Forces Engineer School. He holds a master's degree in Civil Engineering from M.I.T., and is a registered professional engineer in New York and a Fellow, American Society of Civil Engineers.

THE BLOOMING MENACE

ENGINEER STAFF

The evening sky twinkled with a mixture of stars and sparks from a line of river steamers stretching for miles along the wharves and levees. A lazy river breeze spread odors of jambalaya, shrimp creole, and oyster gumbo across the waterways. Laughter from milling throngs bore witness to the "Business Boom in the South," as Frank Leslie's ILLUSTRATED Newspaper proclaimed.

President Garfield's assassin had been dead for two years. The Brooklyn Bridge had been open for a year, and to most Americans it seemed that all was right with the world. Was there ever a more propitious occasion for an exposition like the New Orleans Cotton Centennial of 1884?

Not as far as James and Estelle Chalmers could imagine. They sat in the parlor car of the southbound evening train, touching hands, and smiling. They were taking many pleasant memories back to their home in Palataka, Florida. James had the foresight to bring back a few souvenirs. The prize was a few seeds from an exotic floating plant he had purchased. A lavender-blooming, orchidaceous plant with glossy leaves, its flowers, which seemed fragile as butterfly wings, had blooms that lasted only a few days.

James would plant the seeds in their lawn fountain. Later they would overgrow the fountain. After being pulled out of their choked bed, the plants would be dumped into the nearby St. John's River and forgotten . . .

From this gentle and innocent act on a peaceful night in 1884 emerged a biological invasion of the nation's waterways that, over the last three-quarters of a century, cost many millions of dollars in control expenditures and economic losses.

The invading menace is named Eickhornia Crassipes—more commonly known as the water hyacinth. The generic title for this botanic wonder honors a Prussian minister, J. A. F. Eickhorn, who lived from 1779 to 1856. His exact connection with these stubborn plants, if in fact he ever saw one, has been lost to history. Likeliest explanation for the name was the practice of European botanists of the time, naming plants for famous men regardless of any association they might have had with the species.

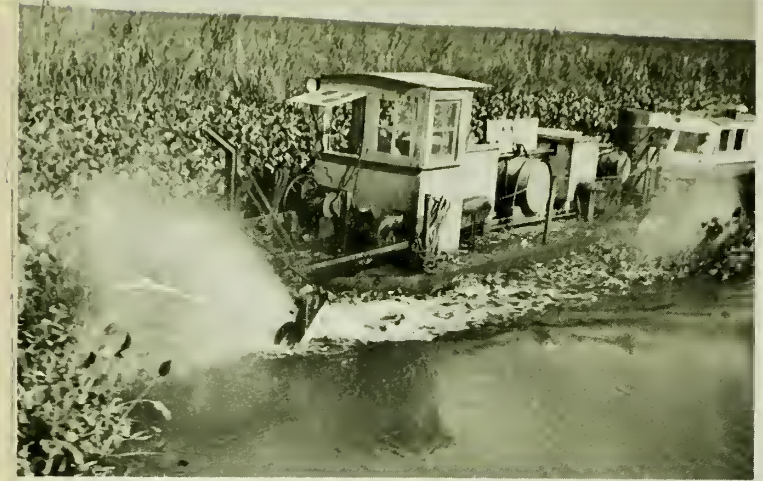
By 1896, Eickhorn's namesake had spread throughout most of the St. John's River Valley. By 1900, steamboat navigation on the river between Jacksonville, Florida, and Palatka had virtually ceased due to the aquatic infestation. Other gardeners and flower fanciers soon spread the pretty water hyacinth from Florida, through the Carolinas, and finally to Texas.

It was around this time that the U.S. Army Corps of Engineers was directed by Congress to do what it could to control this growth that was overwhelming waterways and menacing shipping. Seventy-odd years later Army engineers are still quietly battling to control this and other channel-clogging infestations. It is not a simple task.

How does one effectively dispose of a plant which is 10 percent or less fibrous substance and 90 percent air? —Plants that grow up to six feet above the water's surface? —Plants with trailing gray roots that appear lacy and fernlike underwater but are a bulky, sodden mass when uprooted?—Plants which multiply so rapidly that each might spawn 60,000 more in a single growing season?

The engineers tried dynamite to blast out the enemy. Oil mixtures were dumped on the plants and set aflame. Also employed were knives, pitchforks and axes in "hand-to-hand" combat. The tenacious water hyacinth seemed undefeatable.

As man began to use the water channels for pleasure by building housing and shopping areas along the canals, he unwittingly became an ally to his old enemy—human waste. It and other sewage were dumped into streams. Fertilizers



A sawboat attacks a mass of water hyacinth clogging a once navigable channel (upper left photo). An engineer works over small, isolated patches of "the menace" with defoliant (upper right photo). The target—one water hyacinth plant—is shown in the bottom photo.

running off from lawns and agricultural areas brought more nutrients to the hardy morass that was steadily creeping across the waterways.

The mechanical harvester, sawboat, and similar waterborne lawnmowers churned into the canals. The expensive result was improved conditions in locales where the machines were employed. Even so, nothing prevented the reinfestation.

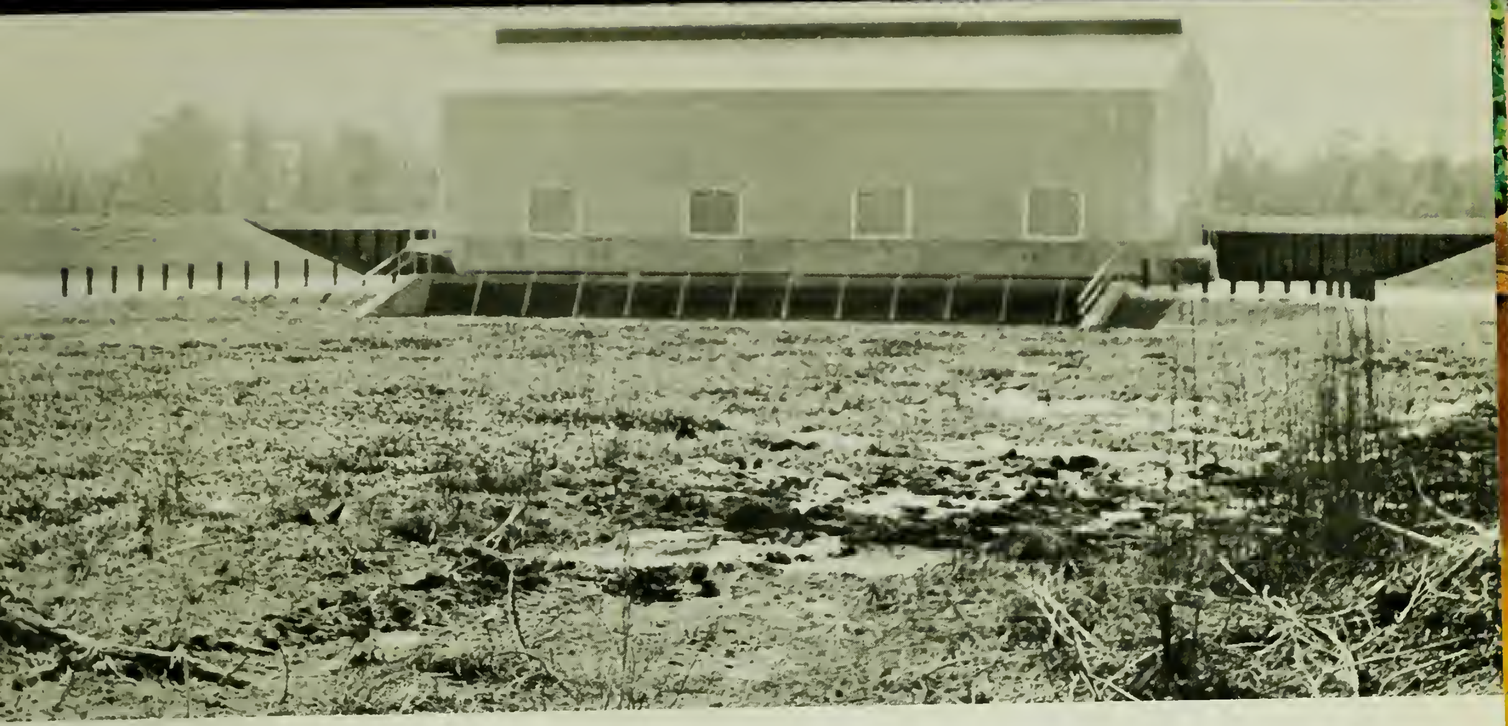
Engineers fought back with herbicidal chemicals like sodium arsenite and plant hormones. Dumped or sprayed from aircraft, boats and swamp buggies, the chemicals noticeably retarded growth. The Engineers had entered the Chemical Age. But we also had entered an age of environmental concern. Ecologists, naturalists and other citizens viewed chemical treatment with misgivings. Although herbicides have not been known to be injurious in any way to public health when used, the Corps of Engineers became concerned about this possibility and about side-effects of chemicals that might prove adverse to other elements of the river ecology.

This concern led to de-emphasis of chemical control in favor of developing other methods. These developments produced unusual results. Two thousand Argentine Flea Beetles, for example, were gathered from the Savannah National Wildlife Refuge, which nestles on the Georgia-South Carolina border. Lengthy tests showed the voracious insects considered Alligatorweed—another river-clogging hindrance to boaters and fishermen—a gourmet delight. But they would eat nothing else. Another victory for the water hyacinth!

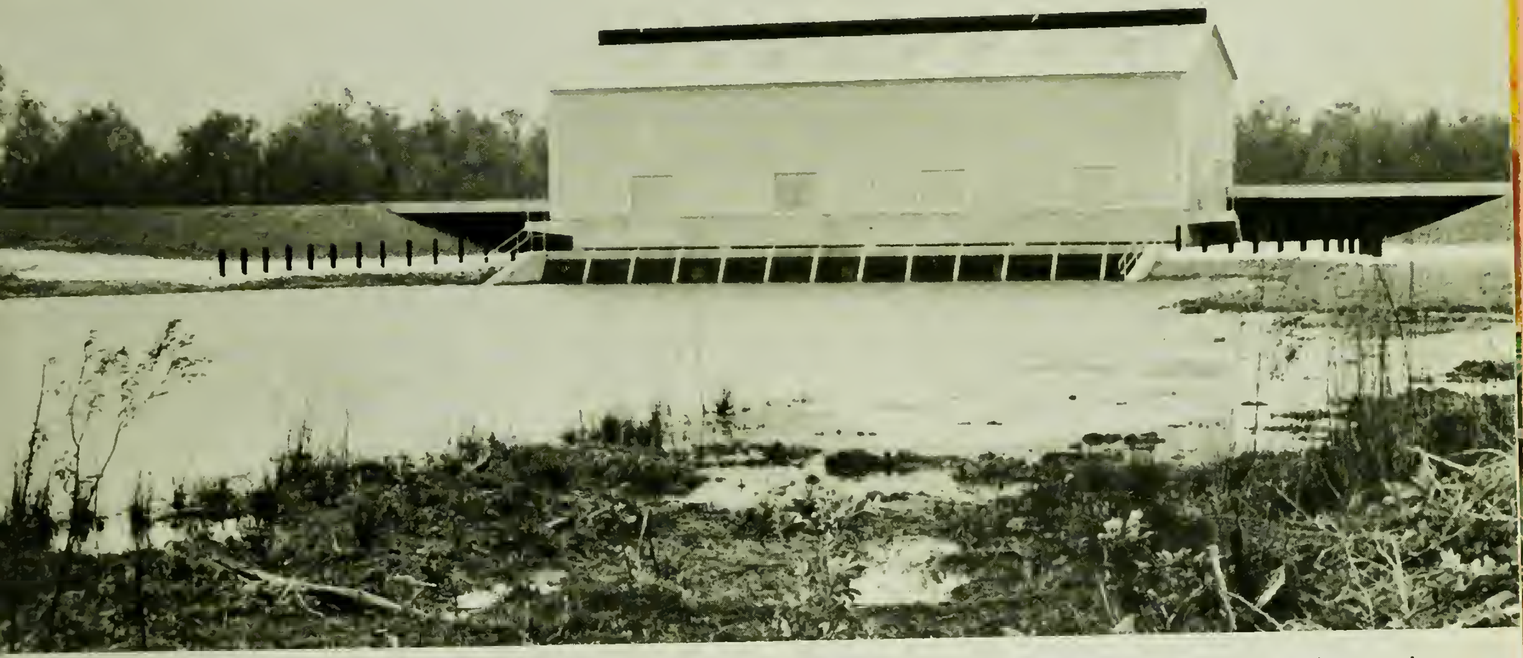
Experimenters also tested a variety of biological agents that included tiny mites, fungi, moths, grasshoppers and huge manatees—sea cows which have ravenous appetites for the lily-like plant.

A curious candidate for hyacinth control is the White Amur, a weed-eating pan fish. Ranging from five to six pounds, the amur is a fine gamefish with a light, succulent taste. Developed in Russia, China and Thailand, it was used to control vegetation and keep irrigation canals clear. Since Thais must depend on their canals for transportation, bathing, and garbage disposal, large morasses of hyacinths ("Java Weeds" as the Thais call them) can disrupt household routine as well as water traffic.

Other ideas are being explored. A specie of plant-eating South



These two photos show the hyacinth's before and after effect on a pumping station.



American snail might prove effective as a deterrent. Harvesting the hyacinth for cattle fodder, though it would be expensive, is being studied. Even the use of lasers are being considered.

Meanwhile the orchid-like scourge continues to grow, damming up normal water flow and causing increased evaporation of water in channels. It immobilizes water transportation, stifling marinas and depressing waterfront real estate values. It harbors snakes and mosquito larvae within its rounded leaves. Hyacinth roots even sap oxygen from the water, with adverse effects on fish populations.

Yet, even with its treacherous history, the water hyacinth is illegally but commonly sold in certain areas of the U.S. as an ornamental plant for about $1.50.

At this very moment the offspring of James and Estelle Chalmers could very well be driving home from an enjoyable Northern vacation with a fragile lilac-blooming time bomb nestling comfortably in the back of their station wagon.

Bridging

ENGINEER SPECIALISTS GETTING NEW SYSTEMS ENGINEERED MOS TYPE MANUALS

A SINGLE, CONSISTENT DOCUMENT which will facilitate school and unit training and correspondence course preparation and serve as a pro-pay refresher and field reference is currently "in the mill" at the U.S. Army Engineer School at Fort Belvoir, Virginia, for each of several military occupational specialties (MOS). These MOS manuals will be numbered for the specific occupational specialty, and each will carry an individual letter designator. Technical Manuals (TMs) 5-62, for instance, will represent Career Group 62, Engineer Heavy Equipment and Maintenance. Within that Career Group, 62B will identify the Engineer Equipment Repairman; 62C the Engineer Missile Equipment Specialist; 62D the Asphault Equipment Operator, and so on. Each lettered manual will contain the material covering all skill levels for that MOS. For example, Part I of the 62B manual will contain only the material required for grade E-3, MOS 62B10. Part II will be an expansion of that material, plus the additional material required for grades E-4 and E-5, MOS 62B20. Following the same pattern, Parts III, IV and V will satisfy each skill level according to career patterns and data bank demands. However, when the basic skill level is a feeder into more than one MOS within the group, reference will be made to that skill level without repeating the same material. Thus, the 62C manual will not contain material for the 10-skill level E-3, but will refer back to Part I of the 62B manual. As of the moment, manuals for carpentry and plumbing have been completed, with TMs for Construction and Utilities Worker (551A), Electrician (551R), Engineer Equipment Repairman (5-562B/20/30), and NCO Administrative Guide (5-590) expected in the near future.

ARMY PICKS UP TAB FOR TWO FULL YEARS OF COLLEGE UNDER OUDP

IT HAS BEEN LEARNED that many officers still do not know about their undergraduate degree program. The Officer Undergraduate Degree Program, (OUDP, AR–621–1, 17 May 1971) is a funded plan that provides up to two full years of schooling with the tuition and fees paid by the government. Under the program, individuals can get four semesters and two summer sessions of schooling. Warrents can obtain MOS-related associate degrees while commissioned officers are earning branch-related bachelors degrees. Permanent Change of Station moves are authorized under this program. Any officer who does not have a branch related degree should contact the Education Officer at the Engineer Branch, Officer of Personnel Operations, for complete details.

TOE CHANGE ADDS NEW THREE-MAN TEAM TO POWER UNITS

A CHANGE in the TOE of Engineer Construction, Utilities and Electrical Power Teams has added Team HK, Radiographic Welding Inspection. Under Change 6, TOE 5-530G, Engineer Construction, Utilities and Electrical Power Teams, this three-man team provides pipeline radiographic welding inspection with the supervision coming from the supported unit Pipeline Engineer (MOS 7932). The team is equipped with an inspection set Line Item Number N95306. The team welders have MOS 44C20 with the additional skill identifier Z3. The same change also has provided the three utility teams (HE, HF, and HG) with the capability to support insect and rodent control. With this change, the Corps of Engineers' installation R&U responsibilities are the same for both the TOE wartime theaters of operations units as the TDA Continental United States and peacetime oversea theater units.

the Gap

ENGINEER BRANCH AND TAGO URGE OFFICERS TO COMPLETE DA FORM 1059 FOR THE FILES

ENGINEER BRANCH urges that officers who have attended civil schools in the past should insure that both the branch and The Adjutant General efficiency files contain a copy of Department of the Army Form 1059 (Academic Report) with complete, official transcripts. This applies to officers who participated in Funded Graduate, DCP, or OUDP, and also to those who attended schooling on any basis but did not complete degree requirements.

INDIVIDUAL WORK PROJECT ADDED TO EOAC COURSE CURRICULUM

COMMENCING WITH CLASS 2, Fiscal Year 1972, of the Engineer Officer Advanced Course, U.S. Army Engineer School at Fort Belvoir, Virginia, the satisfactory accomplishment of an Individual Work Project was established as an additional requirement for successful completion of the course. The projects were introduced into the curriculum as a means of providing meaningful, higher level staff experience which will prove to be invaluable to the student in future career assignments. To recognize excellence, a Commandant's Award for Staff Excellence was established for presentation during graduation. The graduate of each class whose efforts are adjudged to be the best in consideration of the anticipated outcome of the project, the means used to satisfy the outcome, and the professional application of that means in the school's operational environment, will win the award.

NEW CORRESPONDENCE COURSES OFFER SKILL IMPROVEMENT AND ADVANCEMENT OPPORTUNITY

TWO NEW OPPORTUNITIES for enlisted personnel to improve their skills and to advance professionally appear for the first time in the 1972 edition of the U.S. Army Engineer School's "Announcement of Correspondence Courses." Each of these programs offers a means of furthering careers in either the stabilized Army of the future or in the booming construction industry of our civilian economy. The Engineer Skill Training Program (ESTP), which was pioneered at the U.S. Army Engineer Center and Fort Belvoir in 1971 (see **the engineer,** Fall Issue, 1971, page 26), combines correspondence courses with technical and practical training to produce skilled craftsmen in carpentry, masonry, plumbing, and electricity. The program's objective is to make available to all units having a Directorate of Facilities a means of improving their vertical construction skills. The 16-week program has already been adopted at several installations within the United States and overseas. Efforts are being made to obtain recognition by the unions for those who successfully complete the course. Introductory packets of materials are available to interested commands and/or installations and will be sent upon request by the U.S. Army Engineer School. Continuing progress also is being made in improving educational opportunities for enlisted personnel through correspondence courses. The most recent addition is the MOS Correspondence Course Program, which is comprised of a series of courses designed primarily to teach the principles and techniques of special engineer skills. These courses were developed along MOS lines and accomplish a number of purposes: They serve as a basis for learning a skill when coupled with practical on-the-job training; as a review vehicle and refresher for those having had formal training, but who have not practiced the skill recently; and as a means of preparing for promotion or MOS evaluation tests. Courses for 15 common MOS's are now being offered, with additional ones to be added to the list. Submit applications for enrollment on DA Form 145 through unit or activity commanders to the U.S. Army Engineer School, ATTN: DNRI, Fort Belvoir, Virginia 22060.

The Corps of Engineers recognizes the highly complex relationship between nature and man and seeks, as a part of its overall mission, to balance the environmental and developmental needs of the nation. More than that, the Corps has been charged by the President to put a handle on our major ecological problems and then to solve them. "The Environmental Syndrome," beginning on page 16, tells where we're headed, and explains why.

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the engineer

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UNIVERSITY OF ILLINOIS
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FALL 1972

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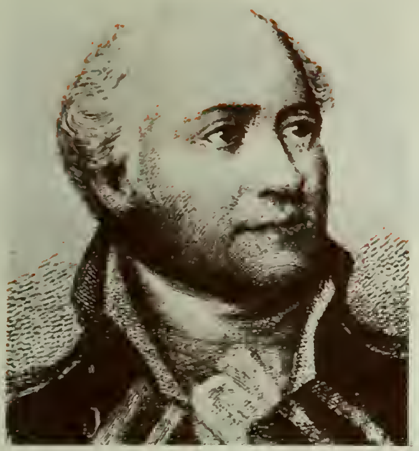

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CHIEF'S BRIEFS.....

When Lieutenant Colonel Stephen Rochefontaine retired from the Army in 1798, President John Adams appointed Colonel Henry Burbeck Chief Engineer and Commandant of the Corps of Artillerists and Engineers at West Point. Burbeck thus became the fifth Chief Engineer of the U.S. Army, a position he held until legislation in 1802 divided the Corps into two new organizations—the Corps of Engineers and the Regiment of Artillerists. Burbeck remained with the latter as its Chief.

Henry Burbeck was born on June 8, 1754 at Boston, Massachusetts. With the growing discontent of the colonists with home rule from England, Burbeck joined the Continental Army, serving in 1775 as a Lieutenant of Artillery under Colonel Richard Gridley, the Army's first Chief Engineer and Artillery Commander. He remained in the Artillery Corps under General Knox, with Washington's Army, until the Yorktown Campaign. Thereafter, his command remained in the north to defend Hudson Highlands, and had the signal honor of marching into New York when the British evacuated that city at the close of the war.

Burbeck was honorably discharged in 1784, but was reappointed a Captain of Artillery to command Castle Williams in Boston Harbor—his father's old command before the Revolution. Later he commanded Springfield Arsenal in 1787 and West Point in 1789. Shortly after serving as Chief of Artillery under General Wayne in 1792, he was assigned the task of building Fort Recovery in the Northwest.

After succeeding Rochefontaine as Chief Engineer and Commandant of the Corps of Artillerists in 1798, Burbeck was also Chief of the Eastern Department of the Army, and played an active role in establishing the Military Academy at West Point. He became the Chief of the new Artillery Corps in 1802, a position he held until he retired in 1815.

Colonel Burbeck died on October 2, 1848 at New London, Connecticut. ⊖

designed for professionals

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Robert G. McClintic

Executive Editor
CPT Dennis F. Pierman

Contributing Editor
William T. Spriegel

Art Director
John W. Savage, Jr.

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ABOUT THE COVER

Art Director John W. Savage, Jr., paints various scenes that depict a representative collection of bridging events that are essential to the mission of the Engineer. They vividly point up one of the Corps' major contributions to the total mobility of the U.S. Army.

Pipeline

CORPS ESTABLISHES DISTRICT TO AID FLOOD VICTIMS

A new U. S. Army Corps of Engineers District has been established in Harrisburg, Pennsylvania, to direct recovery and reconstruction work in the Susquehanna River Basin which was hard hit by Hurricane Agnes.

Headed by Colonel John F. McElhenny, the new Susquehanna Engineer District will take over all post-Agnes emergency work within the basin.

Debris removal, repairs to flood control structures and the reconstruction of public buildings, water supply and sewage facilities are some of the tasks they will perform.

The Susquehanna District also will prepare sites for thousands of mobile homes which will provide temporary housing for flood victims.

ENGINEERS TEST NEW ROAD CONSTRUCTION

A radical departure from conventional road construction methods is gaining prominence with test programs at the U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, and at Fort Hood, Texas.

The process, called membrane enveloped soil layer (MESL), has been developed at the Waterways Experiment Station for application by a small crew in minimal time with minimal equipment. A crew of 12 with a scanty truckload of materials and little equipment, in fact, has laid a one-half-mile, two-lane MESL road in less than a week.

The process is based on the principle that the soil itself will support military cargo vehicle traffic if moisture is sealed off. The only construction materials are plastic membrane, fabric, asphalt and native soil. The construction technique is simple—wrapping native soil between membranes which are joined and sealed along the edges to form a waterproof encapsulated soil system.

A main road at Fort Hood, Texas, was built using the MESL method. Equipment removed the soil which was to be used to form the foundation layer and a grader was employed to smooth the subgrade surface. Polyethylene sheets, each 32 by 100 feet, were spread by hand on the subgrade and front-end loaders placed the soil on the lower membrane. A grader spread the soil, leaving the lower membrane edges exposed for bonding with the upper membrane to be added later.

After careful compacting, the soil was given a light spray coating of rapid setting emulsified asphalt. The surface layer was placed in one operation using an asphalt distributor fitted with a simple laying yoke for unrolling the fabric, a random fiber polypropylene material that comes in rolls 15½ feet wide by 350 feet long, each roll weighing less than 200 pounds. Since all of the materials are flexible, going around bends and up and down hills presents no problems.

After bonding the upper and lower membranes with the edges to be buried later as shoulders, a final application of asphalt was laid on the polypropylene, a material that can absorb asphalt 270 times its own weight. The surface was then blotted with sand and the MESL was ready to serve as the base course. The asphalt-treated fabric became the pavement surface on that secondary road. On a more heavily traveled primary road designated to support the traffic of both civilian and military vehicles, a two-inch surface of hot-mix asphalt pavement would have been laid over the MESL.

Building of the test road at Fort Hood is another goal met in a research program started several years ago at the Army Engineer Waterways Experiment Station to provide the military with a construction technique when aggregates required for conventional roadbuilding methods were not available. Lack of materials for roads in Southeast Asia, particularly in the Mekong Delta, influenced the Chief of Engineers to seek another method. The MESL road system offers a solution, while cutting work, cost and time.

USARPAC HOLDS FACILITIES ENGR INSTRUCTION

U. S. Army facilities engineers from Hawaii, Vietnam, and Thailand, have begun attending a series of U. S. Army, Pacific Facilities Engineers Management Courses.

The first 10-day course, held at Fort DeRussy, Hawaii, was designed to improve the understanding of facility engineering management practices by supervisors at the middle management level.

The immediate purpose of the course, which graduated 42 facilities engineers, was to upgrade the technical and professional training and management skills of the students. They received 54 hours of instruction in environmental pollution abatement, management and administration, maintenance and repair, and management of facilities engineering contracts.

Courses were also to be held in Korea and Okinawa. It was expected that 125 students would receive instruction from the three courses.

84th ENGINEERS ARE CITED BY ADMIRER

The 84th Engineer Battalion (Construction) at Schofield Barracks, Hawaii, recently received a plaque displaying a beat up, rusty, toy bulldozer from an important admirer.

Major General Thomas W. Mellen, former commander of the U. S. Army, Hawaii, presented the plaque in appreciation of the unit's service to the command since its activation on January 31, 1972.

In just nine months of duty in Hawaii, the 84th has grown from a handful of soldiers without even the barest of tools to some 400 with a vast array of equipment. They are working on projects on both Oahu and Hawaii.

The inscription on the plaque from General Mellen, who has been reassigned to Thailand, reads: "To the officers and men of the 84th Engineer Battalion (Construction) with respect, admiration, and thanks. Activated at Schofield Barracks on January 31, 1972, as the 577th Engineer Battalion (Construction) with three officers and 11 men and no equipment, the battalion has performed with great skill and energy under trying conditions. You are truly the 'Do It Yourself' battalion."

Lieutenant Colonel Norman B. Gates, Commander of the 84th Engineer Battalion (Construction), seems delighted as he reads the inscription on the plaque presented to the unit by Major General Thomas W. Mellen (left) former Commander of the U.S. Army, Hawaii.

engineer interview:

with

major Ralph B. Hill

and

captain Milton Hunter

With the advent upon the military bridging scene of two innovations slated for incorporation into the U. S. Army's inventory within the relatively near future—and amid some speculation that the Medium Girder Bridge and the Ribbon Bridge might eventually replace current standard item equipment in that inventory—**the engineer** felt compelled to interview personnel with first-hand knowledge about these two bridges. We were fortunate.

Major Ralph B. Hill, Royal Engineers, is the British Exchange Officer currently serving at the U. S. Army Engineer School at Fort Belvoir, Virginia, and has acquired considerable experience with the Medium Girder Bridge through past assignments. He has been stationed at the Engineer School since March, 1971, and is now Chief of the Field Engineering and Bridging Division, Department of Applied Engineering.

Commissioned into the Royal Engineers from the Royal Military Academy at Sandhurst in 1953, the major holds a Master of Arts degree in Mechanical Engineering from the University of Cambridge and is a graduate of the British Army Staff College at Camberley.

Major Hill has served in various units, on occasion as second in command, and as a troop commander. He has also been assigned duty as a member of the Royal Engineer Combat Development Staff.

As a member of the Ribbon Bridge Field Test Board, Captain Milton Hunter, Corps of Engineers, U. S. Army, is singularly qualified to discuss that piece of bridging equipment. He is a Distinguished Military Graduate of Washington State University's ROTC Program, and holds a Bachelor of Architectural Engineering degree from that institution. Formerly an instructor in the Bridging Branch, Field Engineering Division of the Department of Applied Engineering at the Engineer School, Captain Hunter has served with the 937th Engineer Group (Combat) in Vietnam, and the 339th Engineer Battalion (Construction) at Fort Lewis, Washington. He has just recently returned from duty with the Baltimore and Susquehanna Engineer Districts where he assisted in Disaster Recovery Operations necessitated by the havoc caused by Hurricane

Agnes in Pennsylvania. Captain Hunter is a career officer and is currently attending the Engineer Officer Advanced Course at the Engineer School.

Major Hill was interviewed first.

ENGR: Major Hill, could you give us a brief description of the Medium Girder Bridge (MGB) and some insight into its capabilities?

HILL: The MGB is a deck-type equipment bridge using aluminum alloy components, which can be assembled very rapidly by a platoon sized force of engineers, without cranes, in a variety of spans up to 160 feet, including a 100-foot span capable of carrying a Class 60 tank.

ENGR: What prompted the development of the MGB with the Bailey already the standard tactical fixed bridge in both British and U. S. Army inventories?

HILL: The Bailey has not been a standard tactical fixed bridge in the British Army for many years now, although we do still have stocks for use in world-wide emergencies. We replaced the extra-widened Bailey (wider than the M2 version used by the U. S. Army) with a similar, heavier and stronger bridge called the Heavy Girder Bridge (HGB) in the early fifties. However, both the Bailey and HGB take too much time, manpower and logistical effort for requirements imposed by fast, mobile, modern warfare. The infantry and armor are just not prepared to wait while the engineers take hours to build their bridges.

ENGR: Do you think the MGB will totally replace the Bailey M2 Panel Bridge? If so, when?

HILL: You're asking me to stick my neck out—and, perhaps unwisely, I will. No, I don't think it will totally replace the Bailey. The MGB is a brilliant design, but it is too specialized to fill the many roles of the Bailey—it's also too expensive. Although the MGB is more cost-effective than the Bailey in the conditions for which it was designed, this does not apply when speed, lightness and logistics savings are less important. I cannot see the MGB being used by engineers as "long term" temporary replacement bridges in civil emergencies (except when life is at stake), for special structure in large construction tasks, or even for LOC (line of communication) bridging in war. The special capabilities of the MGB are just not required in these situations, so why pay the extra costs? Also, MGB just hasn't got the flexibility of Bailey although, admittedly, the ingenuity of military engineers will undoubtedly change that in due course. Besides, both the British and U. S. Armies still have large stocks of Bailey, which has a long life, to use up.

ENGR: Does the MGB have any distinct advantages over the Bailey? If so, what are they? Also, could you point up any disadvantages?

HILL: Well, I've already mentioned some of these—the advantages are speed of assembly, and savings in manpower and logistics. The disadvantages are a comparative lack of flexibility (e.g. special uses, longer spans) and straightforward cost. However, the latter is not true in the tactical context when costs of vehicles manpower and logistics are included.

ENGR: The MGB was designed around new materials with weight reduction and minimal assembly time in mind. What is the weight differential between a 100-foot Class 60 MGB and a similar Bailey unit?

HILL: A 100-foot, Class 60 MGB weighs 19.7 tons, compared with over 60 tons for the comparable Bailey.

ENGR: Money is always a factor in introducing non-expendable items with a long-inventory life into the system. How does the expense of a unit of MGB compare to a unit of Bailey?

HILL: As I have already indicated, this comparison is difficult to make. You should really include costs of vehicles and ancillary equipment—and many other factors have to be considered. The MGB will probably be cheaper to maintain, but repairs may be more costly. How do you cost the manpower savings and time saved in a military context? I feel sure that the MGB can produce a cheaper answer to the problems for which it was designed, but in many cases the Bailey cannot even be compared. For example, there is no way to produce a 100-foot Class 60 bridge in one hour using Baileys, and this has been done on several occasions using MGB. However, it is interesting to note that one set of MGB, which will provide one 160-foot double story bridge capable of carrying a Class 16 load will cost between $200,000 and $250,000 as compared to $42,000 for one set of M2 Bailey which will produce one 130-foot double-double bridge capable of carrying a Class 18 load. The Bailey set needs 25 bridge vehicles or trailers, whereas the MGB set can be carried on 12 bridge vehicles or trailers.

ENGR: How long do you think it will take before the MGB is actually introduced into the in-

ventory of U. S. Army Engineer units? Will it be exactly the same as the British version?

HILL: If the bridge is accepted, which seems likely, I understand that the first sets would come into service in the next year or two. It is not yet known whether the bridge would be manufactured in the United Kingdom or the United States under license. However, even if made here, I would expect it to be substantially the same as the British version.

ENGR: Could you sum up the total effect the MGB will have on the bridging capabilities of our Army Corps of Engineers?

HILL: This will depend on how much is procured, and to whom it is distributed. I think the combat engineer will greatly appreciate his new ability to provide a 100-foot bridge rapidly wherever the combat arms want it. The combat arms are going to be impressed too!

ENGR: The MGB reportedly incorporates new materials and design to reduce weight and speed assembly. Can you identify such materials and explain the new design features?

HILL: The bridge is made of an aluminum-zinc-magnesium alloy, which was specially developed by the Military Vehicles and Engineering Establishment (MVEE) at Christ Church, England. These are the people who, under Sir Donald Bailey, developed the Bailey Bridge. The greatly improved strength of this metal alloy for its light weight, made possible the design of the fabricated boxes which form the girders of the bridge. The strength of these girders is achieved without the overall depth of the Bailey Bridge panel-type girder, and thus the MGB is a deck-type bridge rather than a through-girder type like the Bailey. Also the bridge is much stronger in twisting and does not require end-posts, base plates or grillages, because the ends of the girders can just rest on the ground. This greatly shortens assembly time, and also means the bridge can be built on sloping sites without time-consuming preparation of bank seats. The whole key to these time and labor-saving factors lies in the novel guidance system which enables pins to be inserted by hand and the avoidance of grillages and site preparation plus the ability to offload pallets quickly.

ENGR: We know that a cable-reinforcement kit has been produced for use with the Bailey Bridge, which reduces the assembly work supposedly by more than a third. Is a similar kit contemplated for the MGB?

HILL: Yes, but this is some way from being finalized. The MGB is probably not quite as well-suited for this modification as was the Bailey. MVEE(C) has developed a trestle-type pier for the MGB which will enable it to span longer gaps at a higher load-classification, and this is now entering service with the British Army. The cable-reinforcement kit which is being developed by MERDC (U. S. Army Mobility Equipment Research and Development Center) is really a means of lengthening the span-crossing capability of the MGB rather than reducing assembly work, and so offers an alternative to the trestle piers.

ENGR: How long do you think the MGB will remain in our inventory before a suitable improved replacement is developed?

HILL: Developing bridges takes a long time. The experts on both sides of the Atlantic never stop working on new ideas, of course, but as far as I can see, the MGB will take us well into the eighties. There are ideas of longer AVLB's, but these are only on the drawing board, whereas the MGB exists now, and has been well and truly proven. The biggest hope for the future, as I see it, is the helicopter-emplaced bridge, and this depends on newer, bigger helicopters as much as on stronger, lighter bridges. There are ideas of pneumatic bridges and rigid foams, of course, but these are some way off. I think the MGB, together with the MAB and the Ribbon Bridge should see us through to the mid-1980's.

ENGR: Captain Hunter, it is our understanding that you were the assistant project officer for the Ribbon Bridge Service Test that was recently conducted in the State of Washington. What was the purpose of the test and what specifically was involved in your job?

HUNTER: Yes, that's correct. I was attached to the Ribbon Bridge Field Test Board that was sent to the State of Washington to conduct the Service Test. The test staff was from the US Army Armor and Engineer Board located at Fort Knox, Kentucky. The test was conducted to determine the feasibility of the Ribbon Bridge for military use. My specific job was to assist the Project Officer, Major (now Lieutenant Colonel) Norman H. Morrissette, in the execution of the Service Test, to evaluate the proposed methods of employment and to conduct river crossing operations consistent with current bridging doctrines as taught by the U. S. Army Engineer School here at Fort Belvoir. I was also responsible for gathering data in the field during the bridging missions.

ENGR: We've heard the name 'Ribbon Bridge' but this title doesn't really tell us what type of bridge it is or why the bridge was so named. Could you explain?

HUNTER: Surely. The Ribbon Bridge is a sectionalized floating bridge made principally of aluminum. Each module of the bridge can be rapidly connected to another to form a bridge or continuous 'ribbon' across a river. The bridge sections are of two types and are called bays. There is an inner bay and a ramp bay. Each bay is 22 feet long and consists of four sections called pontons. When the bridge bays are unfolded, there are two to each side of the roadway containing a four-foot walkway. The ramp bay differs in that it is tapered on one end (shore end) to provide a bridge approach on the river banks. The ramps are hydraulically operated by a hand pump for ramp articulation to accommodate various bank angles. Each bay is individually transported, launched, and retrieved on our standard 5-ton bridge trucks which have a modified chassis for handling the ribbon bridge. When the bay is launched, it automatically unfolds in the water and the pontons lock together in the unfolded position. Prior to retrieval, the controls are disengaged and as the bay is pulled out of the water, the pontons come together and automatically lock in the folded position as the bay is pulled onto the truck. When you see the bays connected together, forming a bridge across the river, you see one solid strip that someone cleverly compared to stretching a piece of ribbon across the river. Thus the name "ribbon bridge."

ENGR: We understand that the Ribbon is almost a carbon copy of the Soviet Union's ribbon-type bridge. Is this true?

HUNTER: Not entirely. The Russians have a similar bridge that operates in a similar manner. It's called the 'PMP' Bridge and from my limited knowledge of it, they've had it for sometime, maybe as far back as 1961. I can't say that I have much more information than that about that bridge.

ENGR: That's very interesting. Do you think your testing gave the Army sufficient information to decide whether or not it could use such a bridge?

HUNTER: Yes, I do. In fact, the Ribbon Bridge is now a "standard A" item and will soon be in the hands of our troop units. We conducted 100 bridge missions, crossing the bridge thousands of times with a mixed density of vehicles that would normally use this bridge in a tactical situation, and I'm convinced that it proved itself each time. During the test, we were able to observe the bridge used for rafting or bridging, in various stream velocities, day and night, and in various extremes of weather. It was easy to see the distinct advantages of this bridge over any of our present floating bridges in the system.

ENGR: Did you observe any significant problems with the Ribbon Bridge during the test?

HUNTER: There were some problems with the bridge and its carrier that were resolved during the test. Field models that will go to troop units will have these problem areas corrected. One problem was the hydraulic cylinders and the ramp pump. The articulation time on the ramp, to accommodate various bank angles, was too slow. In addition, the ramp angle was limited to the range of 13-15 degrees maximum when crossing the AVLB (Armored Vehicle Launch Bridge) because of the position of the outriggers on the carrier. The outriggers will puncture the deck if the angle of the ramp is any steeper. The ramp pumping system was improved to provide better ramp articulation. Another problem was the smooth roadway surface. The nonskid paint initially used was completely worn after a very small number of crossings and the roadway became a safety hazard in inclement weather. The roadway decking was changed to provide a more durable surface with better traction characteristics. A third problem area was the welded seams on the bridge bays which showed cracks after repeated use. This problem was the result of poor connection of the exterior membrane of the bridge bay as well as poor welding. Both problems were resolved through use of a better membrane connection procedure and positive welds with good quality control. Basically, this means a better way of connecting the membrane to the structural members and using a different type of weld. Other significant problems were associated with the modified portion of the transporter. First, the operator would have a tendency to bring the bridge bay in too close to the A-frame type boom on the rear of the bridge truck during retrieval. This often resulted in damage to patches (controls) on the bridge bay itself. This was corrected by increasing the length of the boom which was found to be too short, and providing a guide on the boom to properly position the bridge bay during retrieval. Finally, the rollers would freeze up during cold weather, or jam due to dirt being trapped in the roller housing; and the vertical tie-downs used to secure the folded bays to the transporter (bridge truck) during travel would loosen during travel. The roller housing was modified to prevent freezing the rollers; two sets of rollers were eliminated; and a better tie-down system was designed.

ENGR: Do you think the Ribbon Bridge is going to be a maintenance burden for field commanders?

HUNTER: Personally, no. There are so few functional components that I think it will be easier to maintain this bridge, and for a longer period of time, before parts have to be replaced.

ENGR: There are rumors that the Ribbon Bridge is expected to replace the M4T6 Floating Bridge. If this is the case, how does operating costs of the Ribbon compare to those of the M4T6?

HUNTER: I'm sure that the Ribbon Bridge will play a significant role in our future river crossing operations. Whether it replaces M4T6 in part, or completely, will have to be decided at the DA (Department of Army) level. Since our test involved the prototype, I can't give a cost comparison to you.

ENGR: Will the Ribbon ever be used in tactical situations in place of the Mobile Assault Bridge?

HUNTER: No doubt it can be, but this will depend on several conditions in any one tactical situation. These variables might include availability of either bridge, density of vehicles crossing the river, and duration of time that the bridge will be required, just to mention a few.

ENGR: Can you give us a "ball-park" estimate as to how soon and in what numbers the Ribbon Bridge will show up in the Army's inventory?

HUNTER: I would probably expect to see the Ribbon Bridge in the field by 1975, but I couldn't say in what numbers.

ENGR: What impact on training requirements of personnel will the Ribbon Bridge have—compared to that of employing M4T6?

HUNTER: I tend to feel that the simplicity involved with employing the Ribbon Bridge will make it possible to train personnel at the unit level and relieve service schools to a great degree. This means that a good OJT (on-the-job-training) program at the unit level is important for effective training. The rapid emplacement capability will also give the unit commander more opportunities to improve the unit's training exercises as a whole.

ENGR: How did the troops who tested the Ribbon Bridge respond to it?

HUNTER: We had quite a mixture of opinions on the Ribbon Bridge because of some peculiarities that existed on this particular test. The bridge test was conducted using members of the 18th Engineer Company (Panel Bridge), which is a separate company attached to the 864th Engineer Battalion (Construction) located at Fort Lewis, Washington. The company was augmented with sufficient personnel to perform a float bridge company mission. Although many of the men recognized the simplicity of employing the Ribbon, I felt that the noncommissioned officers who had been in several type bridge units, as well as the enlisted personnel who had previously worked with the M4T6, recognized the tremendous difference of working with the Ribbon Bridge. One of the most memorable pair of comments that I heard during testing was from one NCO who had just come to the unit from an M4T6 Company and, after observing a bridging operation, turned to me and said, "Is that all there is to it, Sir?"—and one enlisted man who had just finished AIT (advanced individual training) at Fort Leonard Wood said, "Sir, this sure beats 'humping' that balk with the M4T6!!"

ENGR: Do you think the Army needs both the Mobile Assault Bridge and the Ribbon Bridge?

HUNTER: Yes, I do. Both bridges have distinct characteristics and capabilities that could easily dictate which bridge should be used in a given tactical situation, but the other important point is that we're giving our bridge units the flexibility and high degree of mobility that they're going to need to support our ground combat forces in river crossing operations in the future.

ENGR: What significant differences did you note in the characteristics and capabilities of the Ribbon Bridge and our standard M4T6?

HUNTER: The most significant difference between Ribbon and M4T6

is the number of components each requires to assemble a bridge of the same length. I would tend to say that a reasonable proportion of parts is 10 to one: M4T6 to Ribbon. In terms of construction time, I'd say that the Ribbon has an assembly rate at least five times faster than that of M4T6, with bay replacement just as fast. Some other notable observations were: The easy passage of debris under the Ribbon contrasted to it hanging up between the pneumatic floats of M4T6; a greater load-carrying capacity in higher currents without additional reinforcements; permanent or short term anchorage can be used; and, finally, the Ribbon lends itself to a greater degree of flexibility in bridge construction as well as rafting.

ENGR: The Ribbon represents an interesting and practical departure from the M4T6. Were the Russians the original designers of this bridge?

HUNTER: Yes, I believe that they were the first to develop this concept of bridging.

ENGR: Do any other countries other than Russia and the United States have a Ribbon-type bridge in their inventory as standard equipment?

HUNTER: Not to my knowledge. However, several of our allies have displayed some interest in the Ribbon Bridge.

ENGR: Do you think the Ribbon Bridge is worth the money and effort that it will take to get it into production and in our standard inventory?

HUNTER: Yes, very much so. I firmly believe that the introduction of the Ribbon Bridge will enhance troop training, increase our mobility in future river crossing operations, and provide much more flexibility in bridging.

ENGR: The Ribbon Bridge is to be one of our tactical bridges. Aren't there too many components for it to be practical in a combat situation?

HUNTER: Negative. As I stated earlier, there's a tremendous reduction of components on the Ribbon Bridge which actually increases the Ribbon's desireability for useage in combat situations; especially where time is a vital factor in conducting a successful operation.

ENGR: Could you give us a brief summation of what this new bridge will mean to the U.S. Army and the Corps of Engineers?

HUNTER: Yes. I think that the Ribbon Bridge will become a very important item of equipment in the Army's inventory. It will add that element of speed to our tactical operations that can be a very influencing factor in modern warfare. Further, it will assist the Army in being able to highly mobilize its combat forces. As to the Corps, bridge units will develop a new image by becoming "self-sustaining." They will have that added dimension to their mission; that is, employ the bridge that they transport, maintain and provide technical assistance for its use. Training will become more professional without requiring excessively long field exercises; thus, becoming more meaningful. The Ribbon Bridge will, undoubtedly, offer all Engineer Officers that employ it quite a challenge. It's an excellent bridge and it has possibilities for employment in future river crossing operations that will only be limited by the bridge commander's imagination. ⊖

CETEX 72: An

Engineer troops from four North Atlantic Treaty Organization (NATO) member nations have a better understanding of the capabilities of each other's combat bridges and rafts these days.

It all happened earlier this year when engineer soldiers from Germany, France, Canada, and the United States participated in a week-long exercise called CETEX 72. Hosted by the 7th Engineer Brigade (Combat) of the VII U. S. Army Corps, headquartered in Kornwestheim, Germany, the scenario required the troops to get a feet-in-the-mud, hands-on-equipment look at each other's combat bridges and equipment.

It was easier for the soldiers to understand their respective roles in the exercise than why the operation was named CETEX 72. But it was not all that difficult. CETEX 72 is an acronym with another acronym inside it. CETEX stands for CENTAG Engineer Training Exercise and CENTAG stands for NATO's Central Army Group. The 72, of course, stands for the year the event took place.

The reason for the exercise, according to 7th Brigade planners, was to get the NATO engineer troops together for a "feel" of the overall bridging picture in Europe. They selected the Main River below Schweinfurt, Germany as the site for the exercise.

Engineer troops from Germany, France, and the U. S. set up their equipment at eight different sites along the Main to teach each other how to erect their particular bridge or raft.

The two U. S. sites were manned by instructors from the 563rd and 565th Engineer Battalions. The other six sites were manned by the German and French engineers. Then, in the days that followed, contingents of German, French, Canadian, and U. S. engineers visited each site in round-robin sequence to be briefed on a

Exercise In Bridging Understanding

particular bridge or raft.

The 2nd German Corps engineers instructed on how to erect their Medium Girder Festbruecke. And the 3rd German Corps and the German Territorial Southern Command taught how to erect the Hohlplatte and Hohlplatte raft. France's 2nd Corps engineers gave instruction on the intricacies of the Class 60 Bridge.

Members of the 38th Bridge Company of the 563rd instructed in the use of the Bailey Bridge and troops of the 502nd Engineer Company of the 565th taught how to erect the M4T6 Float Bridge. Some of the M4T6 instruction also centered on the Class 60 load.

Highlight of the exercise was the show put on by the assault bridge companies of the NATO-member nations from France, Germany, and the U. S.

The mission of each company was to put a bridge across the Main as rapidly as possible. They put up their bridges in a hurry. First, the French mobile Gillois Bridge vehicles churned into the water and produced a bridge in slightly less than 30 minutes. The Gillois relies on preparatory lateral ponton inflation for buoyancy. Next came the Germans with their mobile M2 Bridge. It took them slightly more than 30 minutes to get their bridge in place. Like the Hohlplatte, the M2 uses its aluminum construction around a hollow deck for buoyance and requires no extensive preparation before entering the water.

The U. S. was represented by Echo Company, 10th Engineer Battalion, 3rd Infantry Division. And Echo did a job. Its members put their bridge together in about 13 minutes—less than half the time it took the French and German companies to put up their bridges. One expert said that the key to the U. S. victory was simply disciplined tight control and quick reaction—engineer bridging musts.

STOP-16

Because STOP 16, our "letters to the editor" department is new this issue, many of the comments reflect views about articles in our earliest issues. The editors encourage timely, spirited response and constructive criticism about **the engineer** *and its contents.*

BLEAH BLEAH BLACKBIRD

Sir/I am working as a Legal Aide with the Corps of Engineers this Summer, which is why I happened to come across the Summer issue of your magazine. I was, to say the least, dismayed by your article "Bye Bye Blackbirds." I have never seen a more blatant example of the application to an ecological problem of that mentality which cannot conceive of any interference with man's efforts to denude the landscape. To set forth as a tremendous accomplishment the following result quoted from your article is maddening, and extremely sad and pitiable:

> "Only charred stumps and a few larger trees remained in their once highly-wooded home."

It is my fervent hope that the 952nd Engineer Company will fade from the memory of man before the trees they destroyed do.

ROY R. ROBERTSON, JR
WILMINGTON, NORTH CAROLINA

THE BLACK HAT

Sir/Having been a tactical officer and later a Company Commander in the Officer Candidate Regiment at Fort Belvoir, I feel qualified to reflect on some of the comments in an article entitled "Grossing Out Delta Company" by Specialist 5 Hugh M. Gildea. There is another side to the coin.

As the author stated, the Engineer Officer Candidate School was implemented to provide officers for the expanding Army and the increasing needs in Vietnam. Based upon my experience as both a combat engineer and infantry company commander, I can say that the prevailing condition in Vietnam did exert a tremendous degree of both physical and psychological pressure on an officer and that the OCS program was designed to duplicate these pressures as much as possible.

The vices or "plagues" that SP5 Gildea described were real; however, not as concentrated as one might expect after reading his article. The author asks why there was no guidance given to the candidates so they could cope with these problems. The answer is found by examining the OCS program. It was designed to develop maturity and self-reliance which helped the young officers deal with the problems mentioned. The program was geared to the standards and needs of the Army of the late 60's, not the VOLAR Army of the future. The day-to-day activities contained a great deal of harassment, but how else could a young second lieutenant learn to function in the daily situations that would confront him in the real world?

I can't believe that SP5 Gildea would have voluntarily commenced mental training for Vietnam in lieu of waiting in the "tac shack" or shining his brass. Shined brass, boots, etc., instill a high degree of standards and self-respect in the potential officer.

Not only Sp5 Gildea but almost every candidate found fault with his OCS training. For example, the candidates considered the coveted three day pass a poor stimulus for achievement. The EOCS cadre, however, had the responsibility to develop and maintain the highest degree of proficiency and standards in the candidates to insure graduation of qualified second lieutenants.

In summary, I think the author's comments were made based upon his frustration in failure. I cannot begrudge him, for at least he tried. But what is needed now is a look toward the future for improvement and innovation, not an attitude of stacking arms.

CPT JOHN L. NEWELL
UNIVERSITY OF PUERTO RICO

Response to Sp5 Gildea's article has been overwhelming and, for the most part consistent with the "establishment" point of view promoted by CPT Newell. The editors wonder if this is an accurate reflection of prevailing opinion among those exposed to Engineer OCS.

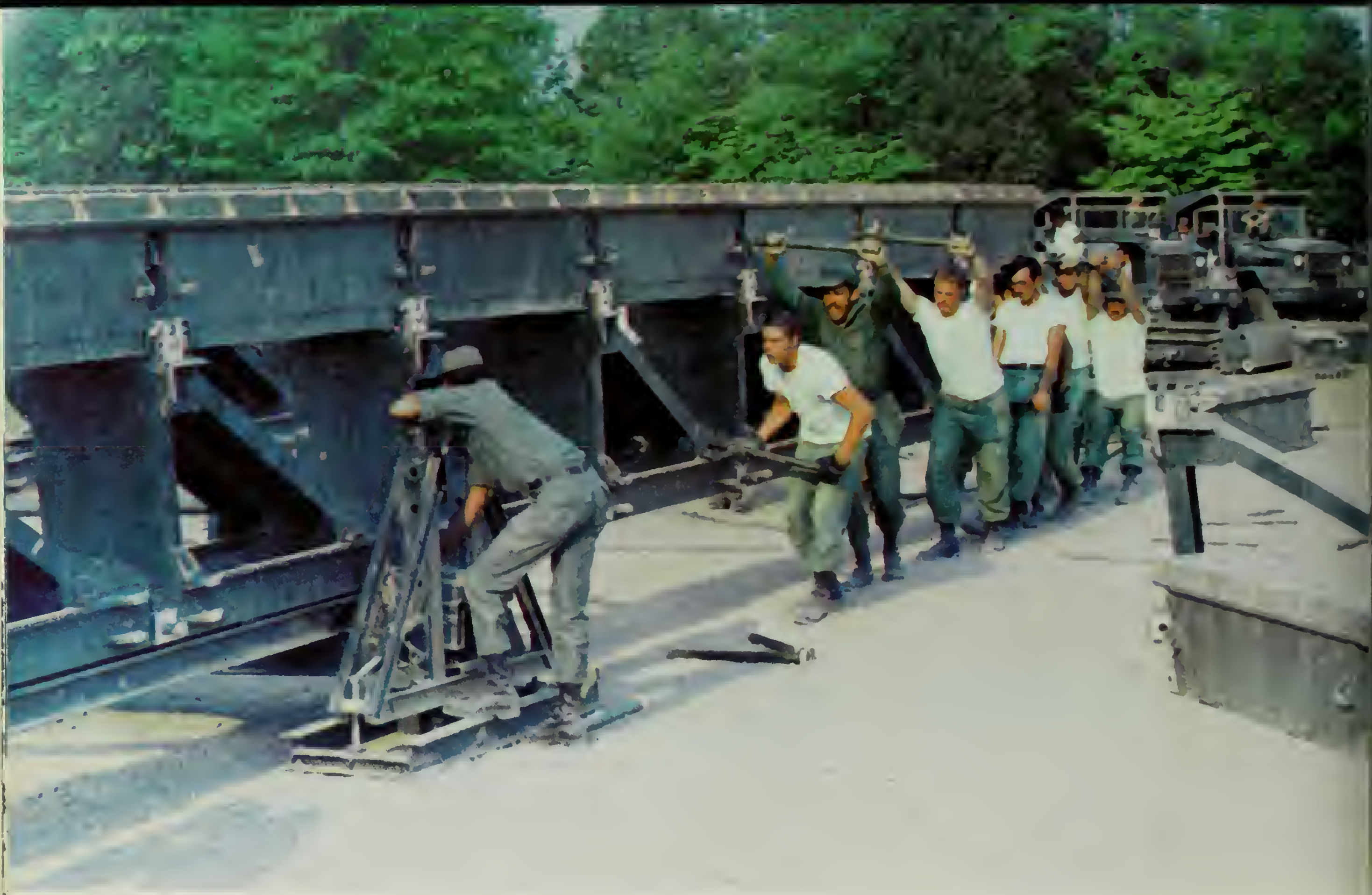
A SUB FOR THE BAILEY

Major Ralph B. Hill

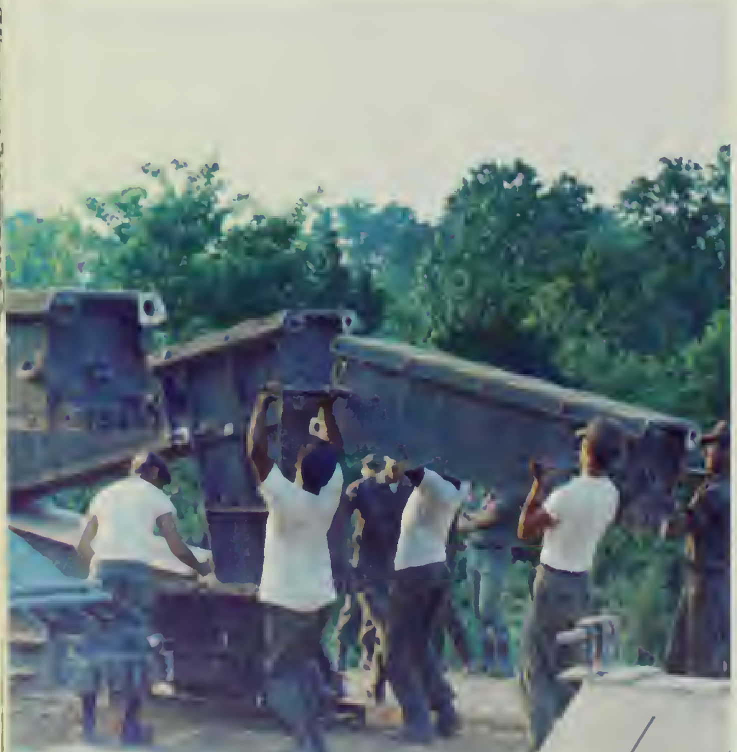
Sir Donald Bailey designed his famous bridge, the Bailey, in 1936. It is still around—and during those 36 years it has been in operation, the Bailey has been used all over the world by allied Armies in all sorts of situations. This must make the Bailey one of the most versatile pieces of engineer equipment ever designed. Evidence of the bridge's usefulness can be seen from Singapore to Saigon via Sicily—all places where for want of a bridge a battle could have been lost.

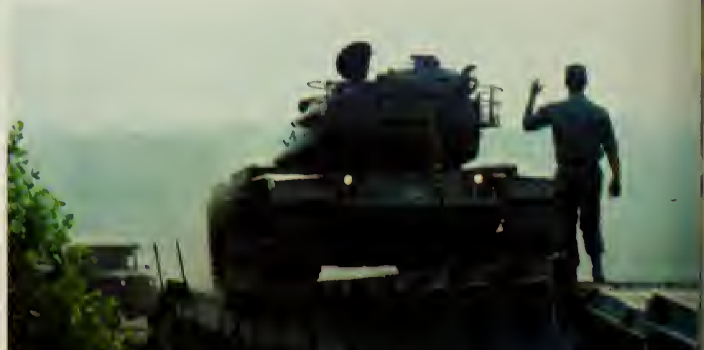
The U. S. Army still has large stocks of Bailey bridging and these will continue to be used in peacetime or in combat for many years to come. Nevertheless, indispensable though it may be as a standby bridge, the Bailey is too demanding of time, manpower, and logistics efforts to provide the solution to the tactical bridging requirement in the combat zone. While the Mobile Assault Bridge and the Ribbon Bridge are answers to part of the tactical bridging requirement, because they provide two flexible and rapid ways of crossing water gaps with floating equipment, there remains a need for an equally efficient means of crossing gaps where floating equipment cannot be used.

The 100-foot gap is crucial for the military. At least 75 percent of all the gaps combat units encounter are 100 feet wide or less. In Western Europe the percentage is much higher—nearly 90 percent.



The photos on these two pages point up the versatility of the new MGB. In the picture above, soldiers boom the bridge forward on the construction rollers. In photo at left, soldiers add top panel to the double story bridge. Below, a soldier guides an M-60 tank across a completed double story bridge. In the photo at the top of page 15, the landing roller is in place to receive the launching nose. The photo (lower right) shows the launching nose being removed after the bridge was pushed across the gap by an M-60 tank.





It was to meet this requirement that the Military Vehicles and Engineering Establishment (MVEE), Christ Church, England, set to work and came up with the Medium Girder Bridge (MGB) for the British Army. In fact, the Royal Engineers have been using the MGB for the past 18 months. Their combat engineer units have been delighted with the ease with which the bridge copes with difficult sites—the ability to almost literally throw it across a gap in periods of time that formerly were an impossibility.

Now the U. S. Army has taken a major interest in the MGB and has been running tests on two sets. The U. S. Army Armor and Engineer Board at Fort Knox, Kentucky, has just completed a "military potential" test of one set. The U. S. Army Mobility and Equipment Research and Development Center at Fort Belvoir, Virginia, is still testing the other set. Although there are no test results yet, it is expected that the U. S. Army will soon begin procuring the bridge as a replacement for the Bailey.

The key to the success of the MGB is the use of specially developed aluminum alloys which are far lighter and much stronger than materials previously used in bridging equipment. Such an alloy will allow for the use of totally different design concepts. This will result in a bridge which is simpler and lighter with fewer components.

The refined design of the MGB will enable 24 men to install a 100-foot bridge capable of carrying a Class 60 load in less than an hour. A 30-foot MGB of the same load capacity can be built by eight men in less than 20 minutes.

A two-girder, deck-type bridge, the MGB can be built either in single or double story configuration. The single story bridge has only six components while the double story, which has deeper girders, consists of eleven.

The MGB has special pallets that were designed to permit rapid offloading of parts from their transport. These pallets enable the components to withstand any shock and strain that could be absorbed during the handling process from storage to destination. No cranes are needed in the handling of these components.

It is interesting to note that all MGBs are launched undecked with a simple, easily assembled single-girder launching nose, over roller beams that are supported on uncomplicated building frames. This is important because the bases can be individually adjusted for height to allow for irregular ground. Then, too, this feature, combined with the lack of bridge grillages and base plates, makes site preparation almost always unnecessary and saves a lot of time and effort.

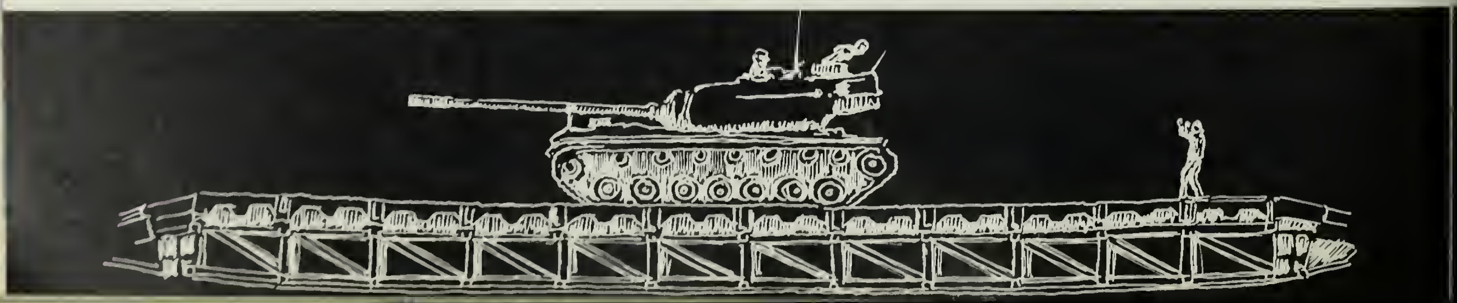
MGB designers have now developed a trestle-type pier that is similar in concept to the one used for the U. S. Army's M4T6 fixed span bridge.

The MVEE at Christ Church enjoys good relationship and close harmony with MERDC at Fort Belvoir. MERDC, for example, is designing a cable reinforcement kit for the MGB that is quite similar to the one it recently developed for the Bailey Bridge. Experts say it is likely that the U. S. Army eventually will add one or both of these devices to its bridging equipment inventory. This, of course, would enable U. S. military engineer units to use the MGB in making gap crossings of more than 100 feet wide for class 60 loads.

MVEE has made considerable progress since it succeeded the British Research and Development establishment which actually developed and produced the Bailey Bridge under the leadership of Sir Donald Bailey.

It is understood that the U. S. Army will probably accept the MGB as a standard engineer bridging item sometime this fall. Following acceptance, the MGB will begin to replace the Bailey in U. S. engineer tactical units as early as Fiscal Year 1974. This event will mark the beginning of the end of an era during which the Bailey Bridge probably has served the U. S. and many other armies better than any other bridge in history. May the MGB prove to be a worthy successor. ⊖

Major Ralph B. Hill, Royal Engineers, is the British Exchange Officer with the U. S. Army Engineer School at Fort Belvoir, Virginia. The major, who has been stationed at the school since March, 1971, is Chief of The Field Engineering and Bridging Division in the Department of Applied Engineering. Commissioned into the Royal Engineers from the Royal Military Academy at Sandhurst in 1953, he holds a Master of Arts degree in Mechanical Engineering from the University of Cambridge and is a graduate of the British Army Staff College at Camberley. After serving in units as a troop commander and second in command on several occasions, Major Hill commanded a Field Squadron in Germany during his last tour of duty. He also has served as a staff officer on the Royal Engineer Combat Development Staff.



THE M4T6 GOES UNDER

Captain David E. Peixotto

How far back does your memory take you? Can you remember World War II, the Korean War, or the war in Vietnam? If you do remember any of these wars, you must remember the Rhine River in Germany, the Imjin River in Korea, or the Mekong River in Vietnam. What these rivers all have in common is that, at one time, each was bridged by U. S. Army engineers using the M4T6 Floating Bridge. Fix that memory in your mind. You may never again see the long, graceful line of black pontons connecting two green shores lined with scores of our exhausted engineers.

The M4T6 Float Bridge reminds one of the old soldier who never dies but merely fades away. In this case, the antiquated M4T6 Float Bridge is not sinking rapidly but it is slowly going under. An improved version of the float concept soon will replace the M4T6 Float Bridge in the inventory of the Army engineer bridge units. This "Improved Float Bridge" is more commonly called the Ribbon Bridge (see "This Ribbon Floats" beginning on page 21). A comparison of the physical characteristics, capabilities, and required assembly efforts of the two float bridges will demonstrate the understatement in the use of the word "improved" in labeling the Ribbon Bridge.

Both the M4T6 and the Ribbon are float bridges but there the similarity ends. Each set of the M4T6 has 688 separate parts that must be hand-assembled to give it an effectitve length of 141 feet. The Ribbon Bridge, on the other hand, has 12 parts per set which gives it an effective length of 290 feet. It takes nine modified five-ton trucks to carry the M4T6 while the Ribbon Bridge is transported on 12.

The capabilities of the two float bridges vary as much as the physical characteristics—

- The M4T6 can cross Class 45 tracked vehicles in a current velocity of eight feet per second.
- The Ribbon can cross Class 60 tracked vehicles in a current velocity of eight feet per second. This is the heaviest load that can be found in a combat division.
- The M4T6 can cross Class 61 tracked vehicles in still water.
- The Ribbon can cross Class 80 tracked vehicles in still water.
- The M4T6 must have an external anchorage system to keep it from being swept away by the river current.
- The Ribbon Bridge may be held in place solely by bridge boats in currents up to eight feet per second while crossing a Class 60 vehicle.
- The M4T6 can carry tracked vehicle Class 45 loads when it is assembled as a raft in the normal five-float configuration with a river current of 10 feet per second.
- The Ribbon can carry tracked vehicle Class 60 loads when it is assembled as a raft in the normal five-float configuration with a river current of 10 feet per second.

Perhaps the most startling comparison of the two float-type bridges is in the time it takes to assemble them and in the effort that is required to get the job done. Try using a bridge length of 300 feet as a comparative vehicle. This is the approximate length of two sets of M4T6 Floating Bridge or one set of the Ribbon Bridge. It would take the services of two combat engineer companies (384 men) plus three float bridge platoons (60 men) four hours to assemble the bridge. The Ribbon Bridge can be assembled in less than an hour by one float bridge company (60 men).

When the Ribbon Bridge finally reaches the production stage and gets in the hands of the user, there will be a great savings in time and manpower. The M4T6 has done its job but changing requirements in an era that stresses greater mobility in future warfare dictates that a change is in order. The new bridge, the Ribbon, will exhibit superior physical characteristics, load bearing capabilities, and required assembly efforts.

The M4T6 Floating Bridge may be going under but it still will be etched in the memories of the engineers who assembled it and relied on it for countless successful river crossing operations long after the Ribbon Bridge becomes just another household word in the vocabulary of the float bridge companies throughout the Corps.

Captain David E. Peixotto is attending the Engineer Officer Advanced Course at Fort Belvoir, Virginia. A 1967 graduate of the United States Military Academy at West Point, he has served a tour of duty as company commander of an Engineer unit in Vietnam.

AN ASSESSMENT OF OUR BRIDGING FUTURE

ENGINEER STAFF

Military bridging has been a low-priority item in the research and development scheme of the U.S. Army for many years now, taking a backseat to smarter bullets, main battle tanks and the like. The portion of the research dollar remaining after assaults by sophisticated weapons systems is hardly enough to cover the olive drab paint used to camouflage the British and Soviet contributions to our inventory of life-sized erector sets.

The U. S. Army, because of these research and development priorities, has adapted and adopted Sir Donald's Bailey and Medium Girder and Ivan's own Ribbon Bridges, the latter "reverse engineered" from an item in the Soviet inventory. This is not to say, however, that these bridges do not just happen to be the most sophisticated and thoroughly proven types available, or that the U. S. Army Combat Developments Command Engineer Agency (USACDCEA) has a better idea waiting in the wings.

But have we got ideas—ideas like the one below, detailed by the Engineer School's Office of Doctrine and Training Development at Fort Belvoir, Virginia, in a letter to CDCEA. Let's follow that idea from its inception through its first series of hurdles.

"The purpose of this letter is to propose that your agency initiate action that will produce a new family of tactical bridging timed with the introduction of the Heavy Lift Helicopter.

It is suggested that this family supplement and eventually replace the Ribbon Bridge and Medium Girder Bridge, and that it should have the following characteristics:

- Designed primarily for transport, emplacement and removal by the Heavy Lift Helicopter.

- Desirably capable of transport, emplacement and removal by the CH54 Skycrane.
- Capable of transport by rail, sea, air and highway, in disassembled configuration.
- Capable of erection and removal by crane, when helicopters are not available.
- Capable of carrying future main battle tanks over dry spans up to fifty meters and in floating configurations of various lengths.
- Have a maximum of parts interchangeable between floating and fixed-span versions.

"It is suggested that bridge components be stocked only in bridge parks at Army or Corps supply points as Class IV items, and not be organic equipment or individual units. Bridges could then be pre-assembled in several configurations based on stream and gap characteristics in the area of operation and into loads close to the 224 ton capacity of the proposed HLH.

When a bridge is needed, an emplacement crew can be flown in by helicopter, with equipment for site preparation and bridge erection boats as required. A small assembly crew at the bridge park would prepare the bridge for helicopter lift to the site.

"Advantages are foreseen as:

- Greatly reduced reaction time.
- Avoidance of traffic and ambush problems enroute to site.
- Elimination of dedicated wheeled transport, and associated needs for drivers, fuel and maintenance support.
- Ability to pre-assemble bridges for specific sites when offensive operations are planned, enhancing the element of surprise.
- Peacetime disaster-relief capability that no civil authority could provide.

Disadvantages would include:

- Dependence upon helicopter support, undoubtedly critical in operational areas.
- Vulnerability of helicopters to enemy fire enroute.

"The advantages seem to outweigh the disadvantages. This future family of bridging is feasible and development should begin without delay. Such a concept should be fully considered so that future engineers will have for once, equipment that is not a generation behind the times."

The Engineer Agency response was prepared with a characteristic thoroughness:

"A new family of tactical bridging timed with the introduction of the Heavy Lift Helicopter is a concept which, as proposed, has several salient features which will be evaluated and studied. These are being examined now in three on-going studies.

"The Engineer Agency is currently involved in several bridging studies. These studies will address and consider many aspects, to include those which are proposed in the HLH-oriented family concept. The results of these studies should lead to a family of bridging and doctrine to provide future engineers the best possible methods of accomplishing their bridging mission.

"At the present time there is a possible requirement for a tactical bridge capable of being emplaced and returned by helicopter. It is highly speculative that this requirement necessitates development of an entire family of such dedicated bridges.

"All means which allow for rapid employment of tactical bridging should be investigated; however, dedication of an entire family of bridging, geared to the Heavy Lift Helicopter appears too restrictive and would surely meet with the official disapproval of Combat Developments Command and Department of the Army.

"The matter of economics plays the heavy role in this picture because bridging by definition is a non-expendable item with a long inventory life. And the Army is committed in that sense to the Medium Girder and Ribbon Bridges which will remain in the inventory into the '80's and beyond.

"Development of the Heavy Lift Helicopter, although its capabilities are considerable and exciting, will produce an item whose availability to the engineer is inversely proportional to its cost, its maintenance requirements and the number of its other basic logistics missions. This availability factor, because the HLH is the key constant in the proposal, must be carefully considered. An alternative and more practical solution might be a more versatile bridge designed for transport and erection by tracked, wheeled and aerial platforms.

"Recent bridge emplacement tests as part of the joint helicopter trials being conducted in England have confirmed that while short bridges could generally be emplaced speedily and accurately by helicopter, emplacement by night was not predictable. In addition, the external bridge load significantly affects the performance of the aircraft.

The trials also disclosed that fins attached to the bridges will be necessary to reduce the mean areodynamic load when the aircraft is in forward flight. A considerable amount of money and research effort is required to solve these problems.

"The way the total bridge picture looks right now, it is apparent that there is a need for three basic types of bridges for 1980 and beyond. The first is an armored vehicular launched bridge type to maintain momentum in the attack. In addition, a tactical bridge for both wet and dry spans is needed beyond the capabilities of the AVLB. Currently, this is handled by both the Mobile Assault Bridge and the Ribbon Bridge for the wet gap requiring floating equipage, and by the Bailey and the Medium Girder where span length permits over wet and dry gaps. The third type is the Line of Communication (LOC) type of semi-permanent bridging.

"Although some of the bridges in or about to be added to the Army inventory are certainly innovative and adequate, there are concepts being developed presently that merit serious consideration. For example, the German "ASB" concept has attractive possibilities and, if successfully developed, could combine the needs of the AVLB, the MAB and the Ribbon Bridge into one concept that is cheaper, quicker to erect and less costly in manpower resources. It would permit a bridge unit to haul, maintain, erect and disassemble without assistance or augmentation.

"Bridging operations cannot be viewed in isolation or as a specialized operation. They should become routine maneuvers for all the combat arms and should be examined in the context of the overall land combat system. In that sense, although airmobility is an essential factor, bridging must be oriented around ground transport and emplacement.

"A tactical bridge such as the M6B for short, dry gap application, while a significant improvement over the M2 Bailey, still falls short of all that is desired. It is hand erectable, but it is expensive. It is fine for short gaps but will have to rely on the cable reinforcing kit for gaps approaching 160 feet that cannot be abbreviated by a pier and a multiple span. Additionally, it does not appear to be helicopter transportable in any meaningful lengths.

"Our doctrine will have to be re-examined. While we now classify bridging as either assault, tactical or LOC, it is hoped that there will be a consolidation down to two types—perhaps just tactical and support. The tactical might include the AVLB, the MAB and the Ribbon Bridge for floating equipage requirements and the Bailey and MGB for limited wet and dry spans. There seems to be no good reason why an improved M6B type of bridge couldn't also fill the support or LOC requirement if procurement and erection costs do not prove prohibitive.

The ideas and potential variations on the proposed concepts are endless and exciting—and endorsed by the British counter-part of CDCEA, the Military Vehicles and Engineering Establishment at Christ Church, England.

The Britishers in response to the Heavy Lift Helicopter family proposal, say:

"The relationship of helicopter emplacement of bridges to the conventional methods of bridging is much the same as that of swimming armored vehicles to the Sappers bridges and ferries; that is to say, there is a very definite role for both of them but both the helicopter emplaced bridge and the swimming armored vehicle are essentially opportunity weapons, whereas the conventional bridging in both cases is the normal method of crossing.

"The rationale for this statement is three-fold. First, it is very hard to believe that there will ever be enough large capacity helicopters, even in the USA, to cover all the bridging requirements. Second, we believe there will always be some sites which will defeat helicopter emplacement of bridges. Third, it is doubtful if we will ever, and certainly not for a very long time, be able to undertake the work under all weather conditions by day and by night.

"On the other side of the coin, the capability of helicopter emplacement of bridges is a most valuable additional method of getting the bridges there very fast, and we should study all its implications. Therefore, all aspects of the basic concept except the suggestion that this family of bridges should be for helicopter emplacement exclusively, have merit.

"The United Kingdom has been doing quite a lot of work recently to study scientifically the problem of flying these bridges.

It has already been determined that very worthwhile lengths of our new bridging equipment can be carried with existing helicopters. There are, sadly, no current plans for a future United Kingdom Medium Lift Helicopter.

"It is important that current and future bridges incorporate any necessary features to enable them to be helicopter emplaced and that the necessary procedures and air clearances are established. Another most important requirement is that the technique is studied tactically as well as technically.

"A specifically designed bridge would have to be lighter in weight (possibly at considerable cost) and would also probably be constructed in larger sections. It would undoubtedly be interesting to have a comprehensive study to establish the parameters which would govern such a bridge and then to compare these in detail with more conventional designs. It is fairly certain that, in fact, a compromise which will not sacrifice very much in either the conventional or helicopter-carried role can be achieved."

We encourage the exchange of ideas as illustrated above. It is this sort of stimulation that our R&D people need to develop and refine doctrine and attractive concepts hidden in the field. With new emphasis on bridging in the R&D budget, ideas introduced into an open forum such as **"the engineer"** *may soon give our own bridge experts the wherewithall to thrust us into the developmental limelight.*

So eat your heart out, Donald Bailey. We're on the way!

THIS "RIBBON" FLOATS

Lieutenant Colonel Clifford C. Lussier, Jr.

The U.S. Army has long needed an improved floating bridge system that would increase its capability to rapidly cross non-fordable wet gaps.

It is a well-known fact that the current military float bridge equipment in the engineer inventory, with the exception of the Mobile Assault Bridge/Ferry (MAB), does not provide the speed of assembly that is a "must" requirement to enhance the mobility of today's rapidly moving ground forces.

To alleviate this problem, the Army has developed a bridge that can be emplaced at least five times faster and with fewer personnel than our present float bridge equipment. The bridge that can do all these things—the Ribbon Bridge—has come through the pre-production tests with flying colors. So, with the testing out of the way, the Army's newest military floating bridge is almost in the hands of the engineers.

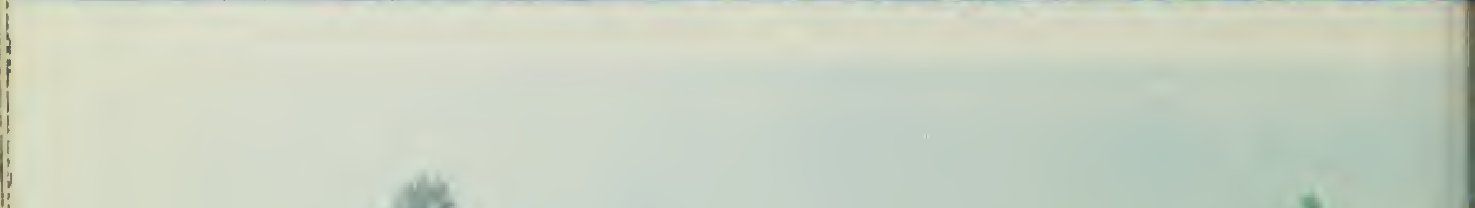
The service test, last of the pre-production series, was completed early this year. This test, which was conducted under the direction of the U. S. Army Armor and Engineer Board from Fort Knox, Kentucky, was carried out over a period of some five and one-half months in Washington State. The fast water portion of the testing was conducted on the Skagit River in the vicinity of Lyman, Washington, some 125 miles north of Seattle. There the stream velocities were recorded at more than eight feet per second. The still-water portion, to test the bridge's ruggedness and durability was carried out on Lake Sequalitchew at Fort Lewis, Washington. Many agencies conducted engineering tests before the service test to establish the structural adequacy of the equipment and the feasibility of the ribbon bridge concept.

In the case of the Ribbon Bridge, the service test was conducted by the Armor and Engineer Board and the support was provided by the 18th Engineer Company (Panel Bridge) of the 864th Engineer Battalion (Construction) at Fort Lewis. To enable the unit to test all characteristics of the Ribbon Bridge, the 18th Engineer Company was augmented with power boat operators, vehicle repairman, engineer equipment repairmen, and medical personnel. The 3rd Armored Cavalry Regiment of Fort Lewis provided the tracked vehicles and personnel that were needed to perform the required trafficking on the assembled bridge.

The service-type test, of course, helps the Army determine whether a new piece of equipment is "suitable" prior to being type classified as standard. In addition, this test is conducted to determine the degree that the system and its complete maintenance package meet the characteristics described in the appropriate requirements document. Scientific methodology is employed, and, insofar as possible, a realistic tactical environment is maintained through the use of military personnel representative of those who will operate and maintain the equipment in the field.

Since the fast water portion of the test was conducted on the Skagit River, complete field facilities were established at the site. Maintenance facilities up to and including direct support, and billeting and messing arrangements for more than 150 personnel were set up on Army-leased land.

Test operations on the Skagit began more than a year ago to obtain the data that was required to determine the reliability, durability, and functional suitability of the Ribbon Bridge system. During these tests, the Ribbon Bridge system was emplaced through 100 erection and disassembly cycles and subjected to a total of 29,077 vehicular crossings. Included in the latter total were 5,963 Class 60 crossings.



The Ribbon Bridge performed exceptionally well under all test conditions. Some of the more important test results included—

- Swift bridge erection—Engineers achieved a construction rate of 550 feet per hour in a stream velocity of 6.2 feet per second.
- Reduced manpower—It took only 53 engineers 39 minutes to erect 357 feet of bridge, including anchorage.
- Conventional anchorage unnecessary—Only transporters and bridge erection boats were used to anchor 357 feet of bridge in a stream velocity of 8.0 feet per-second when crossing Class 60 vehicles.
- Rafting capability—Engineers were able to raft with Class 60 loads in stream velocities up to 6.4 feet per second.
- Air transportable—Ramp and interior bays were successfully transported, launched, and retrieved by a CH-47B helicopter.

The Ribbon Bridge is a Class 60 tactical floating bridge system consisting of three major elements—interior bays, ramp bays, and transporters. The interior bay consists of a four-ponton, folding module with the necessary locks and hinges that enable it to be transported in a folded configuration and to unfold flat to form a 22-foot section of bridge.

The ramp bay also is composed of a four-ponton, folding module. This bay has tapered pontons and has a 6½-foot approach ramp hinged to the thin end. In addition, the ramp bay contains an adjustable hydraulic cylinder which allows the ramp to be articulated. This joint provides a range of angles up to 20 degrees between the ramp and interior bays to meet varying conditions at river banks. The ramp bay provides a total length of about 25 feet of bridging. The transporter used in the service test was an M139A1 truck modified to provide a unit for transporting, launching, and retrieving the bridge bays. (For future models an M812 series chassis will be used as a transporter.) A hydraulic-powered boom and winch provide the means for moving the bays on and off the transporter. Rollers support the bays during on and off loading and locks secure the bays to the transporter during travel. Each transporter carries a single bay.

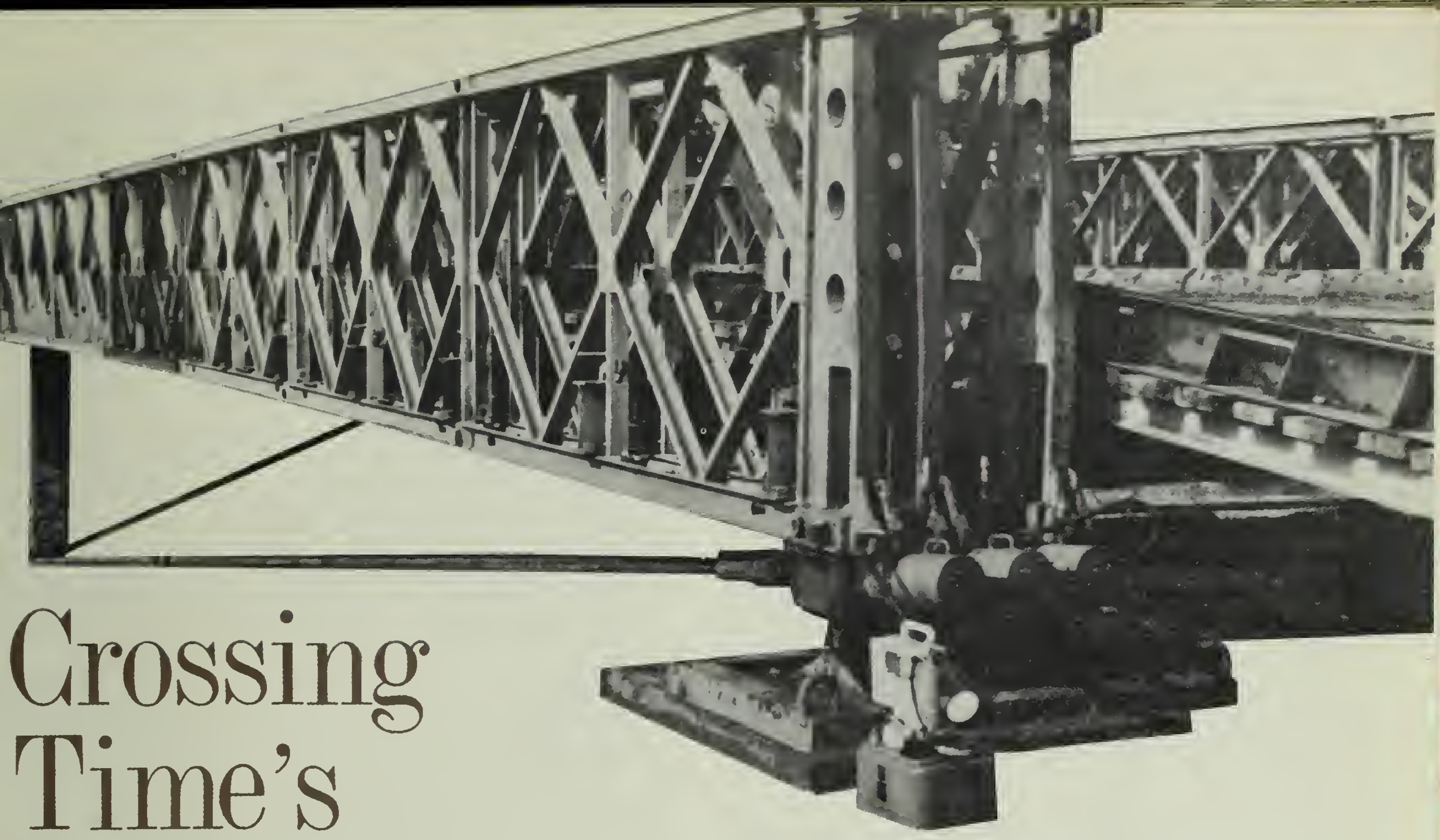
When folded for transport, the single interior bay is 22.5 feet long, 10.7 feet, wide, and 7.7 feet high. When unfolded for installation in the bridge, each floating interior bay is 22 feet long (effective bridge length), 26.5 feet wide (13.6-foot roadway), and 3.5 feet deep. The weight of each interior bay is approximately 11,000 pounds or 500 pounds per foot of bridge. When folded, the ramp bay is 18.4 feet long, 9.8 feet wide and 7.8 feet high. When unfolded, the ramp bay is 25.3 feet long including the ramp approach which is 26.5 feet wide and 2.4 feet in depth. The weight of each ramp bay is approximately 10,000 pounds.

A Ribbon Bridge can be erected swiftly. The transporters are backed to the water's edge; and, as the vehicle stops, the bridge elements are released and roll off directly into the stream where they unfold and are secured in this condition. Then, the elements are pin-connected to form the required bridge span along the shore. It is then swung across the stream using bridge erection boats to maneuver and anchor the assembled bridge. The bridge can be held in place in a moving stream without anchorage through the use of transporters and bridge erection boats. A conventional system can be used when the conditions of the period of emplacement of the bridge justify it.

This Ribbon Bridge is actually the American version of the PMP Ribbon-type Bridge now being used successfully by the Soviet Union. During the 1960's the USSR developed and deployed the Ribbon-type Bridge that consists of integral float-deck elements connected longitudinally to form a continuous floating roadway. The MPM demonstrated erection speeds up to 10 times as fast as comparable U. S. float spans and a crew size half as large.

Now, the U. S. has its own Ribbon-type Bridge and, as with all newly developed items, there are some bugs remaining to be resolved. Fabrication techniques must be employed to minimize weld failures, and the improved transporter must be checked out. Weighed against the capabilities, the defects appear minimal. For the first time, an engineer float bridge company can, without support, transport and erect a float bridge —and do it in minutes instead of hours. When fielded the Ribbon Bridge will substantially increase the engineer's capability to span wet gaps and will ensure that we keep our tactical ground forces on the move.

Lieutenant Colonel Clifford C. Lussier, Jr., is presently assigned to the Armor and Engineer Board at Fort Knox, Kentucky. He holds a Bachelor's Degree in Management and Economics and is a graduate of the Engineer Officer Candidate School and the Officer Advanced Course at Fort Belvoir, Virginia. The colonel has served with engineer construction battalions in CONUS, Europe, and on group staffs during two tours in the Republic of Vietnam.



Crossing Time's Bridges

ENGINEER STAFF

U. S. Army bridging is beginning to take on a svelte, new shape, tailored to meet the rapidly changing needs of our military requirements on the ground in the years just ahead.

The new bridging equipment, which is expected to give the Army much greater mobility than in the past, has been a long time coming, according to Engineer experts. They claim that for many years now, the Army has been developing exotic new weapons, vehicles, and equipment, while its bridging requirements have been neglected.

It is no secret that success in battle usually stems from superiority in mobility and its employment for effective maneuver. An Army, of course, needs many different capabilities if it is to have total mobility. One of those capabilities—an Army's ability to cross dry gaps and rivers during combat has more often than not determined its success or failure. Bridging, or the lack of it, has had decided effects on the outcome of many history military conflicts.

It is to this end that the U. S. Army has again begun taking a closer look at its bridging capability and beefing up the requirements. Time has almost stood still for U. S. Army bridging through three wars. For example, the Bailey Bridge, named after its British designer, Sir Donald Bailey, was adopted by the U. S. Army during World War II. Throughout the "big war" it was the principle tactical fixed bridge of the allied armies. The Bailey has continued to be the bridging workhorse for the U. S. Army in two subsequent wars—Korea and Vietnam.

Today, though, it looks like the days the Bailey will remain in the U. S. Army inventory as a tactical bridge are numbered. It is expected to give way to another British designed, developed, and produced bridge—the Medium Girder Bridge. Also, a new Improved Float Bridge called the Ribbon is expected to supplement and eventually replace another World War II relic—the M4T6 Floating Bridge. Actually six new bridges are programmed to give the U. S. Army a sleek, "erector set-like" gap crossing capability second to none. They are—

- **Mobile Floating Assault Bridge/Ferry (MAB)**

Description: *The MAB consists of three major components—a transporter and two types of bridge sections. The transporter, which serves as a self-powered vehicle on land and a self-powered boat in the water, can carry either type of bridge section. The interior bay bridge superstructure forms a center section of bridge or ferry roadway while the end bay bridge superstructure provides a hydraulically adjustable ramp or end* *section to form a roadway from the river bank to the MAB deck roadway. Amphibious MAB units can travel overland at speeds up to 40 mph and enter the water directly from the approach march. Upon entering the water, the power is transferred from the wheels to the marine propulsion unit and the wheels are hydraulically retracted upward into wheel wells. When the MAB is afloat in the water, the superstructures are raised and rotated to the bridging position and successive units are joined to form either a bridge or a ferry capable of carrying 60 ton Class 60 loads.*

Status: *The first MAB's (riveted aluminum hull construction) were type classified Standard A in October, 1969 and issued to Army units in Europe. Since then, however, the MAB's transporter, hydraulic, and electrical systems have been improved, tested and approved for production by the Department of the Army. A multiyear quantity procurement of the welded hull MAB (in lieu of riveted construction) is now being accomplished. This procurement will result in the fielding of 184 new MABs during Calendar Years 1972, 1973, and 1974.*

Item Replaced: *The MAB provides a more rapid means of tactical floating bridge and ferry deployment and operations in the Class 60 capacity range. It replaces the French designed, German manufactured Amphibious River Crossing Equipment (ARCE) and supplements the World War II M4T6 bridge.*

- **Lightweight Armored Vehicle Launched Bridge, Class 60, 60 Foot Span**

Description: *The Army has tested a first generation unit and it shows great promise for a successful bridge. The bridge, which is all-welded type construction, utilizes the new, high-strength 7,000 series of aluminum alloys. This lightweight bridge weighs approximately 14,000 pounds as compared to 29,000 pounds for the current standard AVLB. The bridge is launched and retrieved by the standard M60A1 launcher. It is intended that it will have essentially the same performance characteristics as the current standard. It is also intended that the sections of this lightweight 60-foot span bridge become the end ramp sections of a follow-on 90-foot span AVLB.*

Status: *A contract has been awarded for a second generation bridge. The U. S. Army's Mobility and Equipment Research and Development Center at Fort Belvoir, Virginia, was preparing to test it as* the engineer *went to press.*

Item Replaced: *Eventually this second generation bridge will replace the current standard 60-foot span AVLB.*

- **Medium Armored Vehicle Launched Bridge (M-AVLB)**

Description: *The M-AVLB is a hydraulically operated, single-folding bridge that is designed for multicellular box beam construction with an orthotropic truss web panel deck in high strength, weldable aluminum alloy. The bridge consists of four tapered ramp sections which are pin-connected through a non-eccentric (two-center) hinge to form two treadways. Horizontal and vertical bracing join the treadways to form a complete bridge. The bridge is folded and unfolded through the operation of a hydraulically controlled three link mechanism. The bridge is 63 feet long, 10 feet, 8 inches wide, and provides a 10-foot roadway, 2 feet 6 inches deep. The estimated weight of the bridge is 7,500 pounds. The M-AVLB is being developed for transport*

and deployment by the currently standard M551 (Sheridan) tank and will support Class 30 combat loads over gaps up to 60 feet. It will be launched from either end without exposure of personnel, in less than two minutes and retrieved from either end in less than 10 minutes.

Status: *Type Classification 4th Quarter, FY 1977.*

- **90-Foot Armored Vehicle Launched Bridge (AVLB)**

Description: *The 90-foot AVLB is a hydraulically operated, double-folding bridge with orthotropic plate deck and space frame truss structure in high-strength, weldable aluminum alloy. The bridge consists of four tapered ramp panels and two center panels which are pin-connected through a non-eccentric (double-centered) hinge to form two treadways. Horizontal and vertical bracing join the treadways to complete the bridge. A new folding and unfolding system using two hydraulic cylinders eliminates the conventional quadrant and cable system used on the present 60-foot bridge. The bridge—95 feet long and 13 feet, 4 inches wide—provides a 12-foot, 6 inch roadway, 3 feet deep. The estimated weight of the bridge is 19,000 pounds. The extended span AVLB is being developed for transport and deployment by the currently standard M-60 Launcher and will support divisional combat loads (Class 60) over gaps up to 90 feet. It will be launched from either end, without exposure of personnel, in less than five minutes and retrieved from either end in less than 10 minutes.*

Status: *Type Classification 4th Quarter, FY 1977.*

- **Improved Float Bridge (Ribbon Bridge)**

Description: *The Ribbon Bridge, an American version of the PMP Ribbon-type Bridge now being used successfully by the Soviet Union, consists of integral float-deck elements connected longitudinally to form a continuous floating roadway. There are two basic bridge elements, interior and ramp bays, and a companion transporter, which also serves to launch and retrieve individual bays. Folded for transport the single interior bay is 22½ feet long, 10-feet, 6 inches wide, and 7 feet, 7 inches high. When unfolded for installation in the bridge, each floating interior bay will be 22 feet long (effective bridge length) 26½ feet wide, (13-foot, 6 inch roadway) and 3 feet, 8 inches deep at its bows and 29 inches deep at the roadway. Folded for transport, the single ramp bay is 18 feet, 7 inches long, 10 feet, 2 inches wide, and 7 feet, 7 inches high. When unfolded each end bay is 18 feet, 4 inches long and has a 6-foot, 5-inch approach ramp hinged to the roadway sections. Its roadway is 29 inches deep at the bridge end and tapers to 15 inches at the shore end. The configuration is the same as the interior bay, except for an adjustable joint at the interior bay connection and the tapered end section. Controlled by two hydraulic cylinders, the joint provides a zero degree to 20 degree range of angles between the ramp and bank to adjust automatically to the variety of conditions that exist at river banks. The weight is approximately 500 pounds per foot of bridge. The Ribbon Bridge will be transported on a modified M812 truck chassis in the folded*

condition. The transporters will be backed to the water's edge; and, as the vehicle stops, the bridge elements will be released and will roll off directly into the water where they will unfold and be secured in this condition. (The elements will then be pin-connected to form the required bridge span along the shore and then swung across the stream using bridge erection boats to maneuver and anchor the assembled bridge, or it can be constructed by using the method of successive bays or rafts.) This bridge will be capable of construction at a rate of 22 feet per minute to cross Class 60 vehicles over streams with currents up to 8 feet per second.

Status: *Type Classification Date—4th Quarter FY 1972*

Item Replaced: *Supplements M4T6 and Class 60 Floating Bridge.*

- **Medium Girder Bridge (MGB)**

Description: *The British MGB is an aluminum alloy structure capable of spanning gaps up to 100 feet. Longer gaps may be spanned using the intermediate supports every 86 feet. There are three primary components—the upper girder, the lower girder, and the deck panel. Girders are six feet long and the deck panel is about 10 feet long. The bridge may be assembled in either a single (30-foot Class 60) or double story (100-foot Class 60) configuration. The construction crew is comprised of 24 men and a non-commissioned officer. Work crews normally consist of four men carrying a maximum weight of 370 pounds. All panels are self-aligning. The site preparation is minimal as the bridge is capable of construction on the ground with slopes not to exceed one-in-ten both longitudinally and laterally. Bridge parts are carried as palletized loads, 7,800 pounds maximum, for rapid unloading and easy movements by ground or air.*

Status: *Two sets were delivered to the U.S. Army in FY 1972 so it could make engineering and service tests and determine the feasibility of extending the MGB's Class 60 capability for spans over 100 feet.*

The introduction of these new bridges into the Army's system is bound to produce positive results. Changing technology and doctrine has forced the Army to replace much of its antiquated bridging equipment.

Looking back, military leaders as early as the Civil War fully realized the advantages of being able to quickly surmount physical obstacles and consequently have carried a bridging capability as an integral part of their armies. The importance of military bridging is indicated both by the emphasis our former great leaders have placed on it, and by its effect tin combat.

The Federal Army, for example, was supplied with wooden bridging materials and equipage to use in its operations during the Civil War. The crossing of the James River by General U. S. Grant was an outstanding lesson of Civil War engineering. The crossing proved to be one of the key factors that enabled General Grant to cut off the flow of supplies to General Robert E. Lee, forcing the Confederate Army to abandon Richmond and Petersburg. It took the Union Army only five hours and 50 minutes to assemble approximately 2,200 feet of bridge for the crossing.

The Union Army also had its own floating bridging during the Civil War. It was simple but effective. Pneumatic pontons were made of India-rubber cloth, inflated by a special bellows, and transported by horse and wagon. Each ponton consisted of three cylinders, 20 feet long and shaped at the ends like a canoe. These supported a roadway 11 feet, 8 inches wide, which was considered "sufficient for ordinary purposes." Holes in the cylinders were mended by rubber cloth patches, which the pontonier sergeants were supposed to carry in their pockets at all times, and a cement made of improvised ingredients.

Time almost stood still for U. S. Army bridging equipment from the Civil War to World War I. Much of that old float bridge equipment of the Civil War was still employed by American Expeditionary Force engineers during WWI. At the same time, the Germans had a floating bridge which utilized metal pontons. It was the forerunner of similar bridges of today.

The floating bridge, which is of utmost importance to military operations, really came into its own during WWII when metal pontons and pneumatic float-type bridges were developed in order to carry heavy loads across such formidable rivers as the Volturno in Italy and the Rhine in Germany.

Chief among the pneumatic float bridges was the M2 Steel Treadway which crossed victorious Allied Armies over many of Europe's rivers. Some of the floating treadways were more than 1,000 feet long. Floating bridge equipage also was used extensively in Korea and Vietnam.

Float and fixed bridges, which complement each other during military river crossing operations, proved their importance to organized military operations as far back in history as 600 B. C. when Herodotus, a historian, wrote about a bridge across the Euphrates River to the city of Babylonia. According to Herodotus, the queen planned to have an artificial lake built upstream from the city. So, the engineer decided that while the lake was being filled, and the stream was dry, he could construct 100 stone piers for the proposed timber bridge that would be erected across the water bed. It was noted that as an extra precaution against invaders, the bridge's flooring could be removed at night. Not bad thinking for those days.

First mention of the use of the floating bridge in military operations was a 100 years later. The Persian Emperor Darius introduced this revolutionary gambit back in 500 B. C. He used an expedient floating bridge to cross the Bosphorus and later the Danube with 700,000 men. Although Darius' attack on European Scythia was not successful, the bridge was instrumental in aiding his retreat from the Scythians and the Greeks. Later, after Darius died, his son, Xerxes, attacked the enemy again by using a similar type of bridge. He successfully crossed 3,500,000 men over the Hellespont in seven days and nights.

Alexander the Great used both fixed and float bridges to fulfill his military operations. One of his most famous fixed bridges was the one he had his engineers build across the narrow arm of the sea that lay between the coast of Syria and the strongly fortified island city of Tyre about 330 B. C. The channel was a mile and one-half wide and the causeway was constructed by driving rows of piles and filling between the piles with earth and stone, using logs and brush along the outer piling to retain the material in place. His Army destroyed an entire city and a forest to procure the materials for the construction of this bridge. The causeway was 200 feet wide and had defense towers at regular intervals. When the roadway was nearly completed, the defenders of Tyre sent out a ship carrying bitumen and other inflammable material, rammed it into the side of the causeway, set it afire and tipped naptha and oil off the yardarm. The causeway was so damaged that it was never completed. Even so, Alexander, built a new, wider, and more fortified causeway from another point and captured the city. The entire effort took seven months. The causeway was gradually widened and strengthened later and remained a permanent isthmus connecting the city to the mainland. Alexander also included a ponton train as an integral part of his army, and by using easily transportable half-pontons that could be joined together at the stern, he assembled many floating bridges during the course of his campaigns. All of these bridges proved more successful than the older type of land causeway which he used against Tyre.

Hannibal should have learned something about bridging from Alexander but he did not. He did not include ponton trains in his army and had to rely on large expedient rafts of his river crossing operations. History records that it was the destruction of a bridge that prevented Hannibal from capturing Rome.

Of all the great military leaders, Caesar was probably the first general to have a distinct Corps of Engineers with trained officers and men. He is credited with introducing the timber trestle bridge. He is said to have built this type of bridge somewhere near Bonn where the river is 25 feet deep, 1,500 feet wide, and has a four mile per hour current. The bridge was a series of pile bents, each bent consisted of two pairs of piles, each pair being timbers 18 inches square, well fastened by cross pieces, the timbers parallel and two feet apart. The pairs of piles were driven by use of a pile driver, each pair inclined toward the centerline of the bridge and the pairs were 40 feet apart—presumably at the waterline. A cross-beam, 20 inches square, its ends passing between the piles of the pairs and fastened to make the bent secure, rested upon the uppermost transoms. Longitudinal beams, planking, and earth finished the surface. For additional strength against the current, piles were driven down stream and braced against the bents. Upstream from each bent, a cluster of piles were driven to serve as pier fenders. The construction of Caesar's bridge, including the timber cutting, took 10 days.

Napoleon was another field general who saw the necessity for good military bridging in battle. He made sure that his engineers were well supplied with ponton equipage and other military bridging materials. During his war with Emperor Charles of Austria in 1809, Napoleon built two ponton bridges across the Danube connecting the shores with an island in the middle of the river from which he launched attacks against the mainland.

It is obvious from this brief and sketchy history of bridging feats that the military engineer has striven to design bridges with greater capacity, transportability, and ease of assembly from the earliest wooden rafts or boats and earth bridges to the most recently developed pneumatic, steel, and aluminum bridges. Modern heavy equipment has made possible the handling of heavier and larger sections which facilitate longer bridges using fewer parts than was formerly possible. Thus, with each new development in bridge material, the great rivers of the world have become less of an obstacle to the advance of modern armies.

But there still is a major haunting question regarding the future of bridging in the U. S. Army. When will our own bridging experts develop a bridge that is entirely of U. S. concept and design? The Russians already are testing an underwater bridge. So, about all that is left is an air cushion-type bridge. Will that be the bridge of the 21st century? If so, will it bear our stamp—U. S. all the way, from state-of-the-art to production? Only time will tell.

The Editor

ERCSP–STRUCTURED FOR SUPPORT

A MONUMENT A'BUILDING

Major Jerry M. Lowrance

The "One-Army Concept" is no longer just a figment of the imagination at the U. S. Army Engineer at Fort Belvoir, Virginia. The concept is now a reality.

Although the Corps of Engineers has always looked upon the Reserve Components as vital to the "total" Army picture, there has been a tendency to forget about their role in the Defense posture of this nation until all the "marbles" are up for grabs.

Engineer planners have had contingency plans for many years that call for the bulk of the combat support and combat service support engineer units which would be needed in the event of a national emergency to come from the Reserve Components.

In keeping with the Army Chief of Staff's policy of support and recognition of the Reserve Components mission within the Army establishment, the Chief of Engineers has had a long-standing program whereby members of the staff make annual visits to observe Reserve Component training. The Chief is continually encouraging mutual support between Active Army and Reserve Component engineer units.

The USAES, based on the desires and policy of the chain-of-command, has placed support of Reserve Components high on its list of priorities in the months just ahead. Both USAES and Fort Belvoir have chalked up a fair amount of support for the Reserve Components each year. For instance, the yearly support in the past has included individual and unit training at the post; support of U. S. Army Reserve (USAR) schools at their home stations and Annual Training of selected USAR schools at the "Home of the Engineers." Also, Belvoir has prepared and issued some 148,000 pieces of instructional material each year to Reserve Component units. This is in addition to supporting the 6,800 Reserve Component students that have been enrolled in the school's Correspondence Course Program through the years. The Correspondence program includes the Engineer Officer Basic and Advanced Courses, the Noncommissioned Officer Courses, various Military Occupational Specialty (MOS) Courses, and the Professional Engineer Preparatory Course.

When the stated national policy revealed that a high reliance would be placed on the Reserve Components in any future missions and commitments of our strategic forces, the USAES needed to make few changes in its current support program to get on the bandwagon. And when the chain of command from the Secretary of Defense on down, began placing heavy emphasis on Reserve Component training, the USAES was able to take this new requirement in stride.

Does this mean that USAES is going to rest on its past laurels? No it does not. It simply means that the USAES has a strong base upon which a better structure of support may be built for the Reserve Components. This structure is expected to reflect the efforts of the USAES staff, faculty, students and members of the Reserve Components when current plans are implemented this fiscal year.

Since the beginning of 1972, the stones in the structure have begun to stack up and it is taking the form of a monument dedicated to USAES support of the Reserve Components program. One of the larger stones, for example, would have to be credited to the two weeks of training that was given this past May to the officers and "noncoms" of the 105th Engineer Battalion of the North Carolina National Guard. Its parent unit, the 20th Infantry Division (Mech), is spread out through both North Carolina and Georgia.

At the USAES, the 105th received the "full bore" treatment—training that included complete current doctrine and practice of engineers in combat support of tactical units. The instruction began with a refresher on current offensive and defensive tactics by the Combined Arms Division of the Department of Military Science. This was in keeping with the theory that engineers must know what the tactical commander is doing if they are to provide the best possible support to his operations. Then, the instruction shifted to what the engineers are expected to do to support these tactics. The Combat Support Branch handled this instruction that covered all facets of engineer support in combat operations. Heavy emphasis also was placed on the engineer's role in river crossing operations and barrier planning.

After the "how-to-do-it" was absorbed by the students from the 105th, the Department of Applied Engineering exposed them to the tactical equipment that is available to handle any eventuality. There was instruction in mine warfare, demolitions, tactical bridging, and field engineering. Nothing was left to chance and when the students from the 105th departed Fort Belvoir, they felt—to a man—that they had gained up-to-date knowledge that would help them better support the 30th Infantry Division in any future role.

The former Department of Topography (renamed the Defense Mapping School on July 1), also has contributed some big stones for the structure of the monument. Enlisted personnel from six Reserve Component Engineer Topographic Units have received MOS instruction that includes Platemaker, Multiplex Map Compiler, Senior Topographic Instrument Repairman, Offset Pressman, Intelligence Terrain Analyst, and Soils Analyst. Also, officers of those units have received instruction in such chosen fields as Geographer, Geologist, Hydrologist, Utility Engineer, Highway Engineer, and Soils Engineer.

Most of the students in the aforementioned programs received the same instruction and, in some cases, were in the same classes as their Active Army counterparts. This way both Active Army and Reserve Components personnel were given the opportunity to exchange knowledge and views and gain a renewed respect and confidence in the important part each play in attaining the common goals of "One Army."

Resident instructors have not given all the instruction at the USAES. Four USAR schools, the 2077th from Cleveland, the 2074th from Louisville, the 2091th from Scranton, Pennsylvania, and the 1154th from Jamaica, New York, handled the instruction of Phase VI of the Engineer Officer Advanced Course. The four USAR schools presented Phase VI in four two-week periods. Phase VI, which actually kicked off the summer training program at USAES, also had 369 officers from the Reserve Components enrolled as students.

Although the USAES did not present the actual instruction, it did support the USAR instructors by providing classrooms in Humphrey Hall, Lesson Reference Files, and Training Aids for each subject—Geology, Soils, Drainage, and Pavements. Also Department of Engineering Science instructors assisted their USAR school counterparts in preparing for their classes. This exchange of ideas and methods between the two groups provided still another opportunity for both to recognize mutual goals and to work together toward accomplishing them.

Although the stones have been stacking up regularly, the monument is far from completion, according to the Assistant Commandant of USAES, Brigadier General Richard L. Harris. The general is not satisfied with resting on past accomplishments but wants to continue to march. He has displayed a keen interest in Reserve Components and the support they receive from the USAES. His interest also was evident to Colonel Irving Atlas, Commandant of the 2091 Scranton USAR School. In his Report of Annual Training to First Army, the colonel said, "This unit has been conducting Annual Training Tours since 1952. This unit has never received the benefits of intense and repeated interest in the mission as has been given by Brigadier General Richard L. Harris, Assistant Commandant, U. S. Army Engineer School, Fort Belvoir, Virginia. This extreme interest and desire to be of service was felt throughout the command and made this unit's Annual Training period in 1972 the most rewarding ever."

General Harris is providing some stones himself. He made sure that beginning this fiscal year the Expanded Reserve Components Support Program is a part of the overall Engineer School Operating plan. The purpose of the Expanded Reserve Components Support Program is to improve resident assistance and to extend the assistance to the troops in the field. The program calls for continued resident support, the development and issue of training materials to support unit instruction, and the use of Mobile Training Teams to help the Reserve Components stay abreast of new developments in doctrine and equipment.

Responsibility for the Expanded Reserve Components Support Program has been given to the Department of Nonresident Instruction. However, all departments of the USAES will have an opportunity to contribute to the program. Major Matthew J. Jones, Jr., has been named the USAES Reserve Components Support Officer and will operate the nerve center.

The initial stage of the new program will require coordination with the Chief of Reserve Components at Department of the Army, Continental Army Command, the CONUS Armies, and the eight major Engineer Commands and Brigades of the Reserve Components to determine the types of assistance that will be required from the USAES. Then priorities will be set for the requirements. The assistance could be resident—students attending instruction at the USAES. It could be non-resident—USAES develops training materials for issue both to instructors and students in the field. It could be field assistance—where mobile training teams actually move out and present their instruction in the field. It also could be liaison—the exchange of ideas, requirements and assets between the USAES, other service schools, major installations, and major Reserve Components Engineer Units.

The second stage of the program is geared to satisfy the requirements identified in the first stage in the priority set by the Reserve Components Support Officer. General Harris has stressed that all assets of the USAES will be employed to satisfy these requirements. However, most of the requirements can be satisfied simply by providing necessary instructional material to the units.

Great care is expected to be taken to insure that the USAR schools are not bypassed. They will be utilized to the fullest extent in meeting the requirements of the units in the field.

The bulk of both the resident and field instruction given by members of the USAES will be performed under the supervision of the Core Mobile Training Team. This team will consist of the Reserve Components Support Officer and two "noncom" instructors. The Core MTT will become expert in the top two or three subjects on the priority list. Members of the USAES staff and facility will be required to augment the team's participation in other areas. Also students at the USAES will have an opportunity to augment the Core MTT instruction. For example, students of the 2nd Engineer Noncommissioned Officer Advances Courses presented two days of demolition training to the Demolition Specialists of the 121st Engineer Battalion of the Maryland National Guard during annual training at Camp A. P. Hill last June.

There is a saying at the USAES that its monument of support to the Reserve Components could one day be as high as Mount Olympus if the stones keep stockpiling. The stones representing the implementation of new methods may soon outnumber the ones that were used to lay the foundation of the monument—continued traditional support.

Today, questions directed at a member of the USAES concerning the "One-Army Concept" draw a blank stare. Personnel who were around when it was a "concept" are long gone. In other words, at the USAES, "one-Army" is really a reality. ⊖

MAJOR Jerry M. Lowrance is presently Chief, Reserve Components and ROTC Division, Department of Nonresident Instruction, USAES. He is a graduate of Texas A & M University. His prior assignments include instructorship at the USAES, and troop duty with the 12th Engineer Battalion in Europe and the 65th Engineer Battalion in the Republic of Vietnam.

DYNAMIC

The Engineer Dynamic Training Council at Fort Belvoir, Virginia, our own professional variation on the Army-wide Board for Dynamic Training recently constituted at Fort Benning, Georgia, has been active since its inception in late 1971 studying small unit training. The Council began its work by conducting a local survey of 400 officers, warrant officers and noncommissioned officers to identify problem areas common to their experience and therefore pertinent to units in the field. Using the results of the survey as a point of departure, the Council developed a questionaire for distribution to select units worldwide and began collecting and refining data to reinforce survey findings.

In the interim, while the Council has been awaiting the return of outstanding questionaires, Army Training Plan (ATP) 5-35T has been drafted for testing in the Engineer Combat Battalion in both Active and Reserve/National Guard configurations. It is designed to fill in the gaps left in the Army's training and testing system where the cyclic annual training scheme is concerned.

Units in the field have been screening training ideas and forwarding some interesting examples of home-grown dynamic training in response to the questionaires. The Engineer Command, U.S. Army Europe, has responded with the following:

- Assign combat engineer units an increased construction role under the supervision of the Director of Facilities Engineers.
- Encourage an increase in civic/domestic action projects through decentralization of approval authority.
- Assign U. S. construction units to work shoulder to shoulder with civilian labor to help increase skill levels.
- Provide concurrent training with aviation units that have a heavy lift capability for bridge construction in addition to troop lift capability for engineer reconnaissance, demolition projects, clearing landing zones, etc.
- Use competitive training with side-by-side construction of different types of tactical bridging.
- Promote truck ROAD-E-O's to develop proficiency in handling, loading, unloading, towing, backing, driving, of general purpose vehicles and engineer equipment.
- Use a group marksmanship concept in place of standard individual markmanship training to develop teamwork.
- Increase the use of non-divisional engineer units in a general support role during divisional field training exercises.
- Use construction units for repair and rehabilitation of troop and family housing facilities.

There also was individual response to the questionaire from the United States Army Engineer School, the 18th Engineer Brigade, the 147th Engineer Battalion, the 844th and 871st Engineer Battalions and several overseas headquarters. Some of those personal contributors include:

—Captain E. M. Harris of the 18th Engineer Brigade, who suggested that engineer units assist in improving their local environments through ecology oriented clean-up projects;

—First Sergeant J. W. Wisnewski, 113th Engineer Battalion, who wants to combine engineer missions with combat arms operations. The troops will be able to see the end product of their labors put to practical use instead of having to tear down that item in the manner of the usual post-mortem drill.

—Colonel W. R. Hylander, who proposes that competition between combat and combat support troops be encouraged by, let's say, having the engineers build a tank obstacle and challenging a tank unit to break through.

—Sergeant First Class C. R. Watts of the 147th Engineer Battalion, who suggests week-long squad missions led by Squad Leaders to cultivate teamwork and promote leadership skills in engineer reconnaissance, orienteering, and demolitions.

—Lieutenant Colonel R. H. Carver of USARAL, who would use VOLAR and other funds to hire technically qualified instructors to work with and train personnel in engineer hard skills, an idea used successfully by the 808th Engineer Battalion.

—Lieutenant Colonel J. W. Martin of III Corps, Fort Hood, Texas, who wants to arrange with local contractors for visits at their work sites and on-the-job discussion of the latest construction techniques.

—Captain R. R. Gentry of 871st Engineer Battalion, Austin, Texas, who will substitute more team sports for the standard Army physical fitness program.

—Others have suggested additionally that reserve

TRAINING

component units replace active units on on-going projects for the Summer training period, and that road rallies for drivers of organic vehicles be encouraged as driving and map reading exercises.

One unit, the 52nd Engineer Battalion at Fort Carson, Colorado, described what it is already doing in the civic/domestic action area and on post support projects to give some meaning to training:

—Construction of an outdoor recreation area for the Colorado School for the Deaf and Blind, including the hauling of fifty thousand cubic yards of fill, preparation of drainage structures, designing and installing an underground sprinkler system and laying out a two hundred meter athletic track.

—Construction of a two hundred foot-long earthfill dam.

—Construction of athletic facilities, including a baseball field and basketball, volleyball and tennis courts, for a local church.

—Repair of Boys Club camp facilities.

—Construction of cubicles within troop barracks through the use of VOLAR funds.

A high point of Dynamic Training activity has been experienced with ATP 5-35T which was introduced by Colonel W. R. Hylander in the Summer issue of **the engineer.** The colonel, who is Director of the Office of Doctrine and Training Development at the U. S. Army Engineer School and also head "honcho" of the Engineer Dynamic Training Council, explains that the response to ATP 5-35T has been heavy. He encourages additional response and promises that all requests will be filled, explaining that the concept is felt to provide better and more up-to-date information than is presently available in other engineer training publications.

The engineer training questionaire itself, designed to help identify problem areas that have become barriers to development of innovative training programs, provides some preliminary insight into attitudes in the field. And some people, it would seem, are not happy with the training status quo.

Many company and field grade officers, from both active and reserve component units, complain that the ever-present training inspector from a higher headquarters does little more than promote eyewash. They wonder what ever happened to emphasis on a better, more rewarding training experience for the troops. In fact, many of those same officers rated the small unit type of training at prestigious institutions such as the Military Academy at West Point and other service schools poor, with too much emphasis on the same kind of theatrics. To say the least, a majority of those responding indicated that they did not rate their current training programs as "dynamic."

Serious problems seem to be those endless requirements for non-mission support to higher headquarters and that old pain-in-the-neck personnel turbulence. Lack of sufficient time to conduct meaningful training and rigidly mandatory training programs are additional gripes. Unavailability or inadequacy of training facilities, surprisingly, has not been cited as consistently as might be expected, except in response from Europe and Korea.

Many active and reserve units had interests in common. For example, many expressed a desire for a consumable materials allowance earmarked for training purposes. All seem interested in increased participation in civic/domestic action type projects.

Testing, of course, was an issue in itself, with nearly 20 percent of the respondents indicating that they had never participated in a unit test or exercise, nor had most of them seen company, platoon or squad tests anywhere outside of the European theater.

Construction units in particular seemed to have been particularly neglected in the testing area. They simply had not been tested with the same frequency or in the same circumstances as had combat and other type engineer units.

What has been presented in the preceding paragraphs is only a progress report from your friendly neighborhood Dynamic Training Council. Final results and conclusions drawn from the survey and questionaire will follow in a forthcoming issue of **the engineer.**

In the meantime, the Council needs your help. Send in an accounting of your pet training peeves and suggestions. There has to be a "better idea" out there somewhere.

Write to the Engineer Dynamic Training Council, U. S. Army Engineer School, Fort Belvoir, Virginia 22060.

Bridging

WHITE HOUSE FELLOWS 73-74 PROGRAM ANNOUNCED

THE WHITE HOUSE FELLOW PROGRAM offers a unique career opportunity for a young person between the ages of 23 and 36 years. Each year the President's Commission on White House Fellows selects approximately 15-20 individuals from industry and the military to serve for a one year period as special assistants on the White House staff or with cabinet officers. These gifted and highly motivated young Americans gain some firsthand experience in the process of governing the Nation and a sense of personal involvement in the leadership of society. Since the program began in 1965, nine Army officers have been chosen as White House Fellows. Personnel desiring to participate in this program must first request permission (through channels) to compete, in accordance with AR 621-7, "Acceptance of Fellowships, Scholarships, or Grants," July 1, 1969. Given HQ DA approval, individuals should submit their White House Fellows application directly to the Commission on White House Fellows, The White House, Washington, D. C. 20500. Official application forms and full particulars may be obtained by writing to the Commission. The deadline for submission of applications for the 1973-1974 program is 15 December 15, 1972. Final selection of the winners will be made in May, 1973. The year long (1973-1974) Fellowship begins in September, 1973. Interested Army personnel are encouraged to submit their "request to compete" to DA early in the fall of 1972.

DA PUBLISHES CHANGES IN FLIGHT TRAINING PREREQUISITES

OPO DA HAS ANNOUNCED that a new edition of AR 611-110, "Selection and Training of Army Aviation Officers," has been published and distributed to the field with an effective date of 1 August 1972. Pending revision of Operating Instructions 611-110(1), interested personnel should be aware of two significant changes in the prerequisites for flight training—(1) applicants now need only be a high school graduate or the equivalent but preferably have two or more years of college; and (2), graduates of the AROTC Flight Training Program may be entered into flight training under Class 2 medical fitness standards *only* if applying prior to completing 36 months of AFCS—later applicants must meet Class 1A standards.

ARMY ESTABLISHES WARRANTS' INTERMEDIATE COURSE FOR MOS 621A

A MAINTENANCE WARRANT OFFICER Intermediate Course, comparable to an officer's advanced course, was established recently through the combined efforts of the U. S. Army Engineer School and the U. S. Army Ordnance School. The course is conducted in two phases. The first, approximately 11 weeks in duration, consists of general military subjects and is taught at Aberdeen Proving Grounds, Maryland, to both Engineer and Ordnance Warrant Officers. The second phase lasts for approximately five weeks for MOS 621A, and consists of engineer technical subjects taught at Fort Belvoir, Virginia. Since the entire course is less than 20 weeks duration, it must be funded as TDY from local training funds. All officers eligible to attend were considered in light of their manner of performance, potential value to the Army, education and type of assignments in which the individual had served.

the Gap

SPECIAL MAG OR MISSION ASSIGNMENTS AVAILABLE FOR QUALIFIED PERSONNEL

SPECIAL ASSIGNMENTS with one of the Army's Military Assistance Advisory Groups, or Missions require a real and practical sense of responsibility, capability and initiative. Such requisites apply also to duty with an International or Joint Headquarters, and to service at any of the Department of the Army or Department of Defense Staff Agencies. Qualifications for these assignments are set forth in Tables 11-2 and 11-3 in AR 614-200. If you are interested and qualified, OPO DA will welcome your application. See your Commanding Officer for DA Form 2250 (Application or Nomination for Special Assignment). OPO advises that special requisitions are filled by eligible applicants who apply for special assignments, and by the selection of personnel for screening under the provisions of AR 614-200. The applications (DA Form 2250) are maintained on file at DA for one year, or until requirements exist that the individual may be applied against.

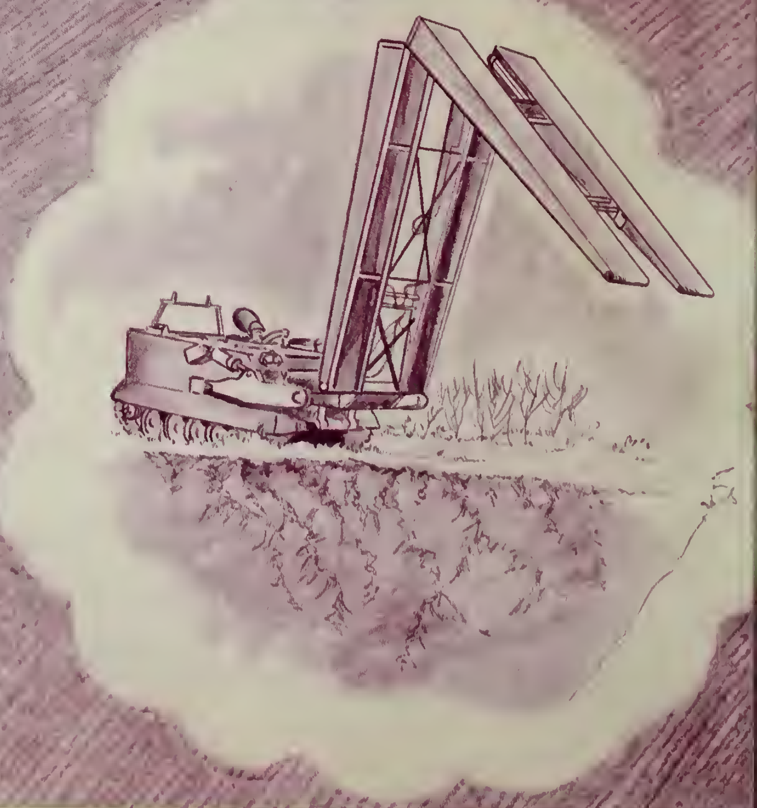
OPO NEEDS INFORMATION FOR NEW CORPS DIRECTORY

OPO DA REPORTS that it is once again time to compile the Corps of Engineers Officer Directory. For those of you who are Professional Engineers or an Engineer In Training and want your qualifications to appear in that new directory, you should check your personnel officer to insure that proper annotation is made on your DA Form 66. Engineer Branch, OPO, advises they have received many calls asking that this information appear, but they cannot make the change without a properly prepared report of change submitted by a personnel office through appropriate channels.

COMMANDER'S UPDATE PACKET IS NOW AVAILABLE FROM USAES

FEW WOULD DENY THAT assumption of command imposes certain responsibilities, and that the larger the command the greater are those responsibilities. Those of you who may be in line for such assignments have probably given considerable thought to the amount of time you will have to devote to becoming current on various subjects with which you would want to be familiar before taking command of a battalion, a group or a brigade. If you feel a bit rusty after that last staff assignment and want to reorient your thinking, the "Commander's Update Packet" may well be your answer. The Engineer School's Department of Nonresident Instruction, in the best interest of those who are unable to make it to Fort Belvoir for instruction—or in this case, the commander's orientation—has put together a packet of instructional material designed to assist the prospective commander in preparing for his command assignment. The temptation to make the packet completely comprehensive or all-inclusive was deliberately avoided to keep the material within manageable proportions. A loose leaf binder format was used to facilitate possible changes, additions or deletions as new information becomes available. Some "nice to have" material has been omitted, but the packet is concise, easily read and includes a wealth of informative material on subjects which occupy most commanders in the early stages of their assignment. If you are on orders to take command of a battalion or higher unit and would like to obtain a "Commander's Update Packet," forward your request to Commandant, U. S. Army Engineer School, ATTN; DNRI, Fort Belvoir, Virginia 22060.

It is believed that military bridges existed in prehistoric times. Why? Because neolithic man had sharpened stone implements with which he could fell trees as far back as 15,000 B. C. The first bridge, per se, was probably a tree he felled to cross a ravine or river that held up the capture or destruction of a village. Some neolithic man became the first military engineer by felling a tree or employing the use of vines to surmount the obstacle that was holding up the advance of his party. To get a better insight on bridging through the years, read "Crossing Time's Bridges," beginning on page 25.



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CHIEF'S BRIEFS.....

Colonel Jonathan Williams, the U.S. Army's sixth Chief Engineer, and the first Superintendent of the U.S. Military Academy at West Point, was born at Boston, Massachusetts on May 20, 1750. He was a grand-nephew of Benjamin Franklin, and acted as his private secretary in London and Paris from 1770 to 1783.

Williams graduated from Harvard University in 1787, and served as secretary of the American Philosophical Society in 1788. He is also credited with founding the U.S. Military Philosophical Society which was established under the motto: "Science in War is the Guarantee of Peace."

By 1801 he had been appointed a major in the Corps of Artillerists and Engineers, and Inspector of Fortifications. When that organization was discontinued, President Thomas Jefferson appointed him Principal Engineer in the new Corps of Engineers. The same act also constituted a Military Academy at West Point, New York, and Major Williams was concurrently designated as the Superintendent of that establishment. He assumed duties as Chief Engineer on April 13, 1802.

With only four officers acting as teachers and a cadet corps of but three, assignments to build fortifications along the coast interfered with any real program of academics. The majority of the commissioned officer instructors were soon replaced by teachers and professors appointed to instruct in special subjects.

As Chief Engineer of the newly created Corps of Engineers, Williams completed the first casemated battery in the United States—Castle Williams on Governors Island in New York. When the War of 1812 broke out he applied for command in the line in accordance with the 63d Article of War, which required the President's approval for engineer officers to command troops of the line. The President approved his request, and in July of that year Colonel Williams returned to the fortification which had been constructed under his direction earlier, with orders to take command.

Colonel Williams resigned from the Army in 1812, and subsequently, in 1814, was elected to Congress.

He died in Philadelphia, Pennsylvania, May 15, 1815 at the age of 65, just four days short of his birthday. e

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Executive Editor
CPT Dennis F. Pierman

Contributing Editor
1LT John S. Horner

Art Director
John W. Savage, Jr.

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ABOUT THE COVER

Art Director John W. Savage, Jr., envisions the type of camouflage the Army of the future will be using in desert operations with this diorama. The authenticity of the scene is complete down to the colors used in the pattern painting, the miniature Sullivan nets, and additional scale equipment.

Pipeline

ACADEMIC CHAIRS CREATED TO HONOR GREAT ENGINEERS

The U.S. Army Engineer School at Fort Belvoir, Virginia, has established three academic chairs to honor men who made history in military engineering.

The school has honored three men who are presently making great contributions to military engineering by appointing them to occupy the academic chairs for a two-year term.

All three academic chairs were created to honor historically famous engineer officers who made contributions to the Corps of Engineers, the Army, and the nation. They are individuals who are now deceased and whose accomplishments have withstood the test of time.

The chairs will be occupied by living persons who have distinguished themselves in engineering in connection with the military. These people, who will ocupy the chairs for a period of two years each, will be distinguished individuals from the military, academic institutions, and private industry.

The three chairs are—Douglas MacArthur Chair of Military Science, Dennis Hart Mahan Chair of Military Education and Training, and the George W. Goethals Chair of Military Construction.

The Douglas MacArthur Chair honors the officer who served the Army for 30 years, and was called from retirement in 1941 to become Commanding General of the U.S. Forces Far East, and later Supreme Allied Commander-in-Chief, Allied Forces in Japan. He then went on to serve as Supreme Commander of the U.N. Forces in Korea. The general graduated from the Engineer School of Application (which no longer exists) in 1908.

First to be named to occupy the Douglas MacArthur Chair of Military Science is General Bruce C. Clarke, U.S. Army (Retired). A 1925 U.S. Military Academy graduate, the general served in Europe during World War II as Chief of Staff and Combat Command Commander for the 4th and 7th Armored Divisions. He later was Commander-in-Chief, U.S. Army, Europe, and Commander of the Central Army Group until his retirement in 1960. Troops called him the "training" general of the Army.

The Dennis Mahan Chair honors a man who gave the greatest impetus to the Civil Engineering program at West Point. A West Point graduate, Mahan became Professor of Engineering there in 1832 and held that post until his death 39 years later. He is generally credited with putting USMA's Civil Engineering course on its feet as during that period, the majority of U.S. engineers, both military and civilian, were educated through Mahan's texts and his department.

First to occupy the Dennis H. Mahan Chair is Dr. Robert E. Uhrig, the Dean of the College of Engineering at the University of Florida. He is a former Associate Professor of Engineering Mechanics and Nuclear Engineering at Iowa State University, Ames, Iowa, from 1948 to 1960. Also Dr. Uhrig later became Chairman of the Nuclear Engineering Department at the University of Florida, and was the Deputy Assistant Director of Research, Department of Defense from 1967 to 1968.

The George W. Goethals Chair is named after the major general who achieved one of the greatest engineering feats in history—construction of the Panama Canal. During this undertaking, he was Chairman and Chief Engineer of the Isthmian Canal Commission from 1907 to 1914. The general was Governor of the Panama Canal the following two years.

Brigadier General Herbert D. Vogel, U.S. Army (Retired) is the first person to occupy the George W. Goethals Chair. A 1924 graduate of the USMA, General Vogel founded and directed the U.S. Army Engineer Waterways Experiment Station from 1929 to 1934. He has served as District Engineer, Pittsburgh; Lieutenant Governor, Panama Canal Zone; and Vice President of the Panama Canal Company. He also was Division Engineer, Dallas, Texas; Chairman of the Tennessee Valley Authority for eight years; and Engineer Advisor to the World Bank during the subsequent five year period. General Vogel is presently a Resource Development Engineer Consultant.

Investiture of the chairs took place late last year. Individuals who occupy the chairs will visit the Engineer School annually and will be invited as honored guests to speak to the students.

TROOPS TO GET NEW MAP READING POCKET HANDBOOK

Just off the press is Department of the Army Training Circular 21-26, "Don't Get Lost," a cartoon style pocket handbook that will simplify map reading for the individual soldier.

Conceived by the U.S. Army Engineer School at Fort Belvoir, Virginia, and developed jointly with the Defense Mapping School and the Combat Arms Training Board, this new look in informal training literature, will be followed shortly by "Don't Get Shot" (Camouflage and Field Fortifications) and "Don't Get Blown Up" (Mines and Booby Traps).

Engineer units that are interested should send their requirements to: U.S. Army Combat Arms Training Board, Attn: ATOPS-TNG-BD-B, Fort Benning, Georgia 31905.

ENGINEERS LEFT LASTING IMPRINT IN VIETNAM

The Engineer Command in South Vietnam closed out its operations in that war-torn country almost a year ago—April 30, 1972. But the memory of its accomplishments during the six years and five months of operation there still lingers on.

First organized on December 1, 1966, the Command reached a peak strength of 33,000 men in 1969 and was augmented with an additional 6,000 Local National employees. At top strength, the Command consisted of two brigades, six groups, 28 battalions, and 40 separate companies.

South Vietnam changed greatly from 1966 to 1972. It changed socially, economically, culturally, and physically. Many of the changes can be attributed to contributions by the engineer soldier who designed and built roads and bridges, trained the Vietnamese on new equipment and technology, opened the country to pacification and scratched out the traces of civilization in jungles and wasteland.

Look at the record: During its tenure there, the command . . . constructed 1,456 kilometers of highway; cleared more than 800,000 acres of jungle; produced 27 million tons of aggregate and 2.5 million tons of asphaltic concrete; used eight million bags of cement, one billion board feet of lumber, three million bags of lime, 2,400 miles of reinforcing steel and 2,000 miles of steel angle; drove 100 miles of piling; constructed extensive logistics centers; managed facilities engineering contracts valued at more than $750-million; maintained 15,000 major items of TOE equipment; and consumed 2.5 million gallons of fuel per month.

Members of the command received more than 1,300 awards for valor that included four Distinguished Service Crosses, 42 Silver Stars, and more than 2,500 Purple Hearts.

Also units of the command earned 123 Meritorious Unit Commendations and eight Valorous Unit Awards.

DINNER DATE SET

The 106th annual Engineer Dinner will be held May 4, 1973, at MacKenzie Hall, Fort Belvoir, Virginia. The theme will be "Engineers, the Corps of Professionals." Additional information may be obtained by calling USAESBDE 3546962.

STOP-16

APPLAUSE, APPLAUSE!!

Sir/In the Fall 1972 issue of the engineer I read with interest of the "Commander's Update Packet." I applaud your efforts in taking what is a very important step to help prepare commanders.

It is a very good little magazine to keep the troops informed. I particularly enjoyed the article on ""Dynamic Training.''
COL HARRY A. GRIFFITH
MOBILE DISTRICT ENGINEER

PARTING GESTURE

Sir/I am retiring from the Corps of Engineers and the Army. As Chief of the Unit Training Branch, Training Division, DCSCOPS, Fort Monroe, Virginia, I have taken particular interest in and watched the engineer grow into a fine publication. In many ways, it is getting to the field and providing our engineer units in the field with data on dynamic training faster than the Combat Arms Training Board.
LTC PERRY D. TRIPP, JR.
GREENVILLE, SOUTH CAROLINA

OLD CHAP

As British Liaison Officer I have found the engineer a most interesting publication and feel certain that some of the engineer establishments and schools in the United Kingdom would welcome the opportunity to read it.
COL P.W.A. HOLDSWORTH
BRITISH LIAISON OFFICER
MERDC

BUTTER BARS

Sir/I enjoyed the DYNAMIC TRAINING feature in the Winter 1972 edition of the engineer. Training has long neded attention of this nature and I am glad to hear that the engineer is trying to obtain feedback from individual units and at the same time establish a means of communicating the Dynamic Training theme to the field.

As you know, we are witnessing a decline in troop strength. That phasedown of forces has created a morale problem in some units that can be resolved to some degree by implementation of a more meaningful training program with an innovative approach to the maintenance of small unit readiness. The dynamic approach to training may be the answer as it has been to some degree with my own unit, the 46th Engineer Battalion (Construction- here at Fort Rucker. It has proven to be an excellent tool for improving morale, sharpening construction skills and providing the means to generate job satisfaction. I think it is the way to develop professionalism.

I and my fellow, inexperienced Second Lieutenants are accepting the challenge of dynamic training with vigor and a competitive spirit. We are eager to learn and to help the troops learn in the process, but we are equally interested in equating that training with projects that can serve a useful purpose to the unit and the community at large.

The 46th Engineers got involved in dynamic training with a community service project for the Boy Scouts. It provided our vertical construction platoons and their young officers excellent training in the erection of a council hut of their own design. They got a good deal of satisfaction from doing the whole job themselves and turning the keys over to a Scout executive with a sense of pride in a job obviously well done.
2LT BYRNE W. STEWART III
FORT RUCKER, ALABAMA

PRIMER

Sir/Congratulations on the Fall 1972 issue of the engineer.

I found it immensely interesting, informative and well written! As well as being a primer on bridging —past and present—it should stimulate a lot of thought on bridging for the future
MG D.A. RAYMOND
SOUTH ATLANTIC DIVISION
ENGINEER

engineer interview:

with captain GEORGE W. GIPE

After many years of seeming disinterest and neglect, the U. S. Army is beginning to take a hard look look at its camouflage program. It was not used extensively in Korea or Vietnam. The reason for this, of course, was the fact that we have enjoyed total air superiority in both of those actions.

. . The U. S. Army Engineer School at Fort Belvoir, Virginia, conducts pure camouflage training for the Engineer Officer Basic Course. The other service schools present camouflage training as an inherent part of combat training—cover and concealment, remaining in defilade, siting of weapons, and patrolling techniques.

Camouflage training also is included in the Officer Advanced Courses, Basic Combat Training, and Advanced Individual Training for enlisted personnel. Infantry AIT inherently contains significant emphasis on various aspects of camouflage and the Engineer's Pioneer AIT course contains camouflage training as a core subject. Other AIT courses incorporate camouflage training into applicable training activities such as bivouacs and field training exercises. Engineer NCOES courses additionally incorporate formal camouflage instruction.

Thus it would seem that camouflage training is well covered within the U. S. Army establishment. The Continental Army Command position, for instance, is the camouflage is an inseparable element of cover and deception and, as such, should not receive any greater emphasis than any other element of cover and deception.

Many experts argue that camouflage training is a matter of discipline. So the engineer staff decided to get a better look at the problem by interviewing a professional in the camouflage field.

Captain G. W. Gipe has some impressive credentials to give credence to his views. He holds a BS degree in Civil Engineering from the University of California at Berkeley and was a Distinguished Military Graduate. After entering the Army, he attended the Engineer Officer Basic Course and then went on to Airborne School.

Captain Gipe served two tours in Vietnam. He was a Platoon Leader and Construction Officer with Company C, 46th Engineer Battalion (Construction) from October 1966 to October 1967 and later was an Advisor to the Ministry of Public Works for the District Engineer, RVN, from March 1969 to March 1970.

Upon his return to this country, he was enrolled in the Engineer

"An increased emphasis in camouflage can be expected."

"Camouflage was virtually ignored in Vietnam."

"The U. S. Army is currently evaluating its camouflage posture."

Officer Advanced Course and graduated in March 1971. He subsequently was named Branch Chief of the Field Engineering Branch of the Department of Applied Engineering at the Engineer School. In this capacity, he has been instructing in camouflage for the past year and one-half, primarily for the Engineer Officer Basic Course.

The captain also has journeyed to Fort Hood, Texas, to get a first-hand look at the Project MASSTER camouflage program during 2nd Armored Brigade exercises. He currently is working on an MS in Civil Engineering at George Washington University.

The engineer's *questions and the captain's answers follow—*

Engr: What is camouflage?

GIPE: I think everyone in the military has a pretty good idea of what camouflage is all about. But it is also important to understand where camouflage stands in relation to Tactical Cover and Deception. TC&D includes all types of deception while camouflage is primarily visual deception. Electronic deception and electronic warfare are not considered part of camouflage.

Engr: What is the present state of the art compared to our allies and potential adversaries?

GIPE: As far as sophisticated equipment used in camouflage and camouflage detection, we feel the U. S. is ahead of most countries. As far as basic equipment, such as camouflage nets, paints and uniforms, we feel we are about average and new development in these areas will put us ahead of many countries. Where the U. S. is far behind our allies and potential adversaries is in practicing camouflage and camouflage discipline. In most countries, when field maneuvers take place camouflage is always practiced as a matter of course. In some countries, disciplinary action up to and including courts martial can result from breaches in camouflage discipline while in the field. This emphasis on and constant practicing of camouflage are the areas where the U. S. is farthest behind.

"I think everyone in the military has a pretty good idea of what camouflage is all about."

Engr: What can we do to improve our camouflage posture?

GIPE: First, we must recognize that camouflage exists on essentially two levels: the small unit where the soldier is concerned about camouflaging himself and his vehicles, and, for lack of a better term—the staff level, where camouflage of large scale operations is planned. To solve the problems at both levels, the first thing that must be done is to convince commanders that camouflage is cost-effective. By that I mean that the cost—the time lost while camouflage nets are being erected and taken down or the time lost by using concealed routes as opposed to open roads—is worth the savings in men and equipment. The second thing that must be done is to incorporate camouflage in all training exercises. This is done to some extent now but in many cases it is little more than a token effort. Tied into the need for camouflage during training is the need for camouflage materials such as camouflage nets. In many areas, nets are just not available. However, there are many aspects of camouflage which can be practiced without nets.

Engr: What about training?

GIPE: Training is very important but I think most soldiers receive sufficient training in their Basic and Advanced Individual Training to successfully camouflage themselves and their equipment. Noncommissioned officers receive training in the NCO Education System. The weakness in the training program is in the Officer Basic and Advanced Courses. Little or no training is given to tactical cover and deception plans or to large scale camouflage operations. We hope the systems engineering of these courses will correct this deficiency.

Engr: How important is camouflage at present?

GIPE: Camouflage and tactical cover and deception in general are a means to an end; the end being one of the Principles of War—Surprise. A commander, in analyzing a specific situation, should consider and compare each of these courses of action in light of these principles. If the commander is not knowledgeable in camouflage and TC&D and what they can and cannot do for him, he will not be able to estimate the amount of surprise he is capable of achieving. For this reason he will not be able to properly apply the Principle of Surprise. Camouflage, because it is a passive security measure, is also part of the Principle of Security. It is one of the tools a soldier can use on the battlefield to stay alive. For these reasons it is very important that everyone be aware of camouflage, how to camouflage, and what it can do for them.

Engr: What experience or lessons have we learned from Vietnam?

GIPE: With the exception of individuals on patrols or ambushes, camouflage was virtually ignored in Vietnam. As a result, we did not really learn anything. As far as I know, camouflage was never used on a large scale so we cannot even say that we would have been more or less successful had we used it.

Engr: What are some of the future trends in this topic?

GIPE: In general, an increased emphasis in camouflage can be expected. At the present time, the Army is evaluating its camouflage posture and I expect in the near future to see some specific results from that evaluation. Some of the areas I expect to see changed to some extent are pattern painting of vehicles, camouflage uniforms, and camouflage training. Project MASSTER, a group set up to evaluate future doctrine and equipment, is currently evaluating camouflage doctrine and training as applied to an armored unit. We expect to get some results on doctrine, training and materials based on what happens there.

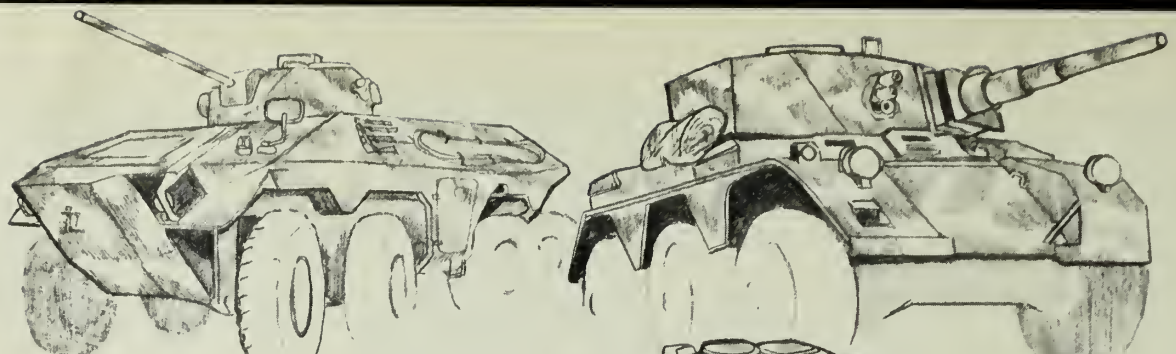
Engr: There has been an increasing emphasis on the arctic environment. How are we fairing in this area?

GIPE: The Mobility Equipment Research and Development Center at Fort Belvoir is currently developing some new camouflage nets that are designed to replace the standard cotton twine burlap garnished net we have had since World War II. One of the series of nets is designed for use in an arctic environment.

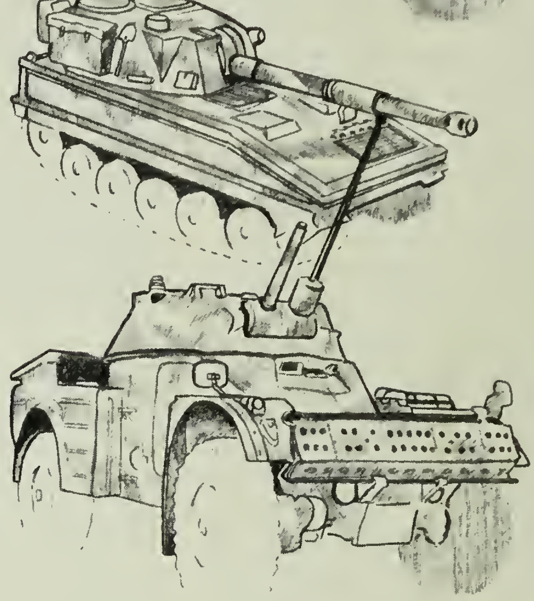
Engr: Has camouflage doctrine changed much in recent years?

GIPE: Camouflage is an interesting and challenging field; one which requires a maximum of initiative and imagination. The doctrine, as far as the basic methods and principles are concerned, has not changed since WWII and probably will not. The new nets and paints that are being developed today will be great assets but, there is a danger in dependency on them for total camouflage. That is where the imagination and initiative come into play because a commander who can effectively deceive the enemy as to his location, strength, and intentions, has got a much better chance of surviving on the battlefield. With today's sophisticated weapons, detection virtually assures destruction.

"Camouflage is an interesting and challenging field; one which requires a maximum of initiative and imagination."



FOUR OTHER FACES OF CAMOUFLAGE



Lieutenant John S. Horner

Camouflage has been used in some form ever since man began using arms to conquer other nations. A classic example is the Trojan horse. It was a huge, hollow horse filled with Greek soldiers that was left at the gates of Troy. As the legend goes, the people brought it into the city during the day but that night the soldiers inside the horse came out and opened the gates for their Greek Army compatriots. The rest, of course, is history. They destroy Troy.

Thus, camouflage is mighty important to any military force. Some countries have virtually ignored it when they have had ground and air superiority but many have not.

The U. S. Army, for instance, has not had to worry too much about camouflage during the Korean and Vietnam wars because it has enjoyed almost total air superiority. And while the U. S. has allowed its camouflage doctrine to blend into the background for at least two decades, some of its allies have been vigorously pursuing improvements in cover and concealment doctrines.

Most of the European nations have long been advocates of a strong camouflage policy. The reason for this is obvious. The short distance between nations has necessitated good camouflage to lessen detection by the opposing country's almost omnipresent air power. To neglect camouflaging in conventional European warfare would be tantamount to installing neon "bomb here" signs at all key military facilities.

Clearcut air superiority is a rare phenomenon in a combat situation in the European theater. It is a luxury no country in that sphere of the world can afford to think it has. With the close proximity of neighboring countries, faster aircraft, and improved surveillance techniques, camouflage has never been more important than it is at the moment.

In an attempt to discover just what developments and doctrines have evolved from our allies in recent years, an **engineer** *magazine staffer got some firsthand information from the Foreign Liaison officers from Germany, Great Britain, France, and Australia who are assigned to the U. S. Army Engineer School at Fort Belvoir, Virginia.*

All four officers have glowing military credentials and are quite aware of the importance of a sound camouflage program in their respective armies.

Lieutenant Colonel Joachim Zickert of the West German Army is a real expert in this field because he *worked on camouflage development at the German Engineer School in Munich and at the Office of the Germany Army in Cologne from 1956 to 1965.*

Major Ralph B. Hill also is no stranger to camouflage. A graduate of the Royal Military Academy at Sandhurst, the University of Cambridge, M.A., and the British Army Staff College, he points out that camouflage plays an important role in Britain's military program.

Lieutenant Colonel Henri C. Aiglon of the French Army says he used camouflage effectively as a combat engineer in Vietnam (1954) and Algeria (1961). A graduate of the French Military Academy at Saint-Cyr, he holds a Masters Degree in Engineering and has served as an instructor at the French Armor School.

Major Ian R. Sarah of the Royal Australia Engineers is another who is no neophyte to camouflage doctrine as it pertains to the Australian Army. He is a graduate of the Royal Military College and holds a Masters Degree in Civil Engineering from the Royal Melbourne Institute of Technology. He has served as a Construction Officer with units in Australia, Borneo, and the Republic of Vietnam.

Each of the four Foreign Liaison Officers painted interesting pictures about the camouflage doctrines of their respective nations. In turn, here is what they said—

GERMANY

Lieutenant Colonel Joachim Zickert developed the camouflage manual utilized by the West German Army.

The colonel believes that the role of camouflage equipment is misunderstood. To illustrate, much attention is given to new net designs, patterns, and material construction, yet nets are primarily "aids" which should be used in conjunction with natural materials (cut branches), in natural surroundings (adjacent to groves of trees). Many of the new nets carried in vehicle camouflage kits cover only a portion of the vehicle. This is to insure that the nets are set up adjoining natural vegetation, to be entirely effective. Concerning some of the new nets being developed by the U.S. Army (i.e. the radar scattering net), Colonel Zickert says that they are technologically interesting and hold great promise for the future if properly developed. However, he adds that the new nets could be "a lot of trouble" due to the care which will probably be required of them so as not to damage the special net coatings.

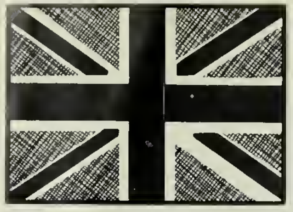
The ideal camouflage color for vehicles is a much discussed topic among NATO nations. The colonel says each country feels it has the best all around color. Some prefer "olive drab," others NATO green. He claims the color can almost be immaterial. The angle of light, natural background, and shadows are the key factors in affecting color selection and camouflage success.

In the area of camouflage simulation, he discussed an incident during World War II where the Germans tried to deceive the Russians on the number and location of motor vehicles by playing through loud speakers the recorded sounds of tanks and trucks moving through the night. Incidentally, the Russians were masters of camouflage during WW II and often operated under the penalty of death for those who failed to camouflage effectively.

Generally, though, the colonel is against gimmickry—inflatable tanks, trucks, and so forth, which have received attention in recent years. He feels that for decoy action it would be far easier to put up many camouflage nets and have one tank mark up the terrain with an abundance of tracks leading into the nets.

Colonel Zickert says effective camouflage is dependent upon three key factors—first, the technical development of the art; secondly, the individual proficiency and willingness of the troops to camouflage; and finally, the amount of emphasis the commander places upon good camouflage. He pointed out that good camouflage is nothing but "hard work." This becomes an aggravated problem when the troops arrive at a site, begin to camouflage properly, then receive the order to move out. At the next location when the word goes out to camouflage, the job will probably be done wtih less attention to detail, if it is done at all. This is where command emphasis plays such an important role in assuring camouflage success.

One final point he mentioned was the trade-off between "rapid movement" and "effective camouflage." It is possible that speed could dictate a limited use of camouflage techniques. With this era of more sophisticated detection equipment (i.e. Side Looking Radar-SLR) and nuclear capability, mobility must be weighed against stationary camouflage.



BRITAIN

During the American Revolution the colonists introduced the British regulars to their familiar fire from behind rocks and trees a la the American Indian and other unsavory but successful fighting forces of the period. The British, of course, were an army of gentlemen—well disciplined, organized, schooled in the classic battle tactics popular at Sandhurst, and well dressed for the pageantry of battle in their red coats. If there had been bumper stickers in that period, you might have seen a comment like "Camouflage is Cutthroat" emblazoned in the colors of the Union Jack on some carriage fixture. Those colonists certainly had some nasty habits!

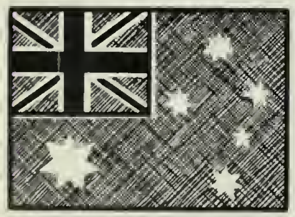
Much has transpired among the British since our political disassociation from Mother. We call it progress, they understatedly call it change. Camouflage doctrine certainly has "changed" since the Revolution, if only in the sense that their combat costume is no longer red and white.

Major Ralph B. Hill, of the Army, discussed the latter day Royal Engineer's approach to camouflage using American doctrine as a point of comparison and contrast. The British, it seems, are more reliant on that old principle—discipline—and implementation of doctrine. That is to say that the emphasis is on the effective employment of available camouflage equipment and gear rather than the technological advancement upon which we seem to do well while our gear catches dust on the shelves. The research and development people are working on sophisticated radar scattering paints and fabric and that is exciting news. If we are paying the attention to troop dispersion and the individual soldier's proficiency with camouflage equipment in our inventory that the British do as a matter of course, it isn't getting too much publicity.

Attitude experience and geography have led the British since WWII to take camouflage more seriously than its U.S. allies. Where we have and have had air superiority and seemingly inexhaustive stores of mobile war machines, Major Hill cautions, the British have had to consider a more finite inventory of equipment, the politics of international alliances with better equipped armies and a tactical role, as a consequence, which is more concerned with defense. Then too, one must consider geography and the close proximity of the British Isles to the Iron Curtain nations of eastern Europe. Experience has taught a lesson about hiding and waiting until the time is ripe for the offensive.

Americans, says Major Hill, seem impulsive and many times appear hesitant about "wasting time" playing at camouflage in a combat environ. The "push-on, keep advancing" philosophy is the way the Americans do battle.

The British camouflage program is expanding and improving, according to Major Hill. Pattern painting is widespread on British tactical vehicles as a matter of policy these days, a departure from the old approach of repainting the olive drab equipment with pattern paint just prior to deployment on an operation. In addition, all vehicles in troop units are equipped with a field camouflage kit that is designed for modification and improvement when employed in a given piece of terrain by individual crews. Camouflage fatigues, too, are being introduced on a replacement basis for the outdated field combat uniform of the past.



AUSTRALIA

The Australian camouflage doctrine is basically the same as the American and British doctrine, says Major Ian Sarah of the Royal Australian Engineers. That country's present outlook, however, calls for a defensive posture, probably conducted in a tropical environment. This has led to a greater emphasis on tropical camouflage development in the Australian Army. The "Land Down-Under" is situated in the Southwest Pacific, bordered to the north by the lush, tropical environments of New Guinea, the Indonesian Archipelago, and finally, the surrounding countries of Southeast Asia.

The major says Australia had a sound camouflage program when it entered the Vietnam war. Jungle camouflage was a fairly well developed aspect of their warfare program and all personnel passed through the Jungle Training Center at Canungra, Australia, before going to Vietnam. At Canungra the troops were able to brush up on their camouflage techniques in a realistic environment.

The "SAS" forces (Special Air Service), equivalent to the US Special Forces, are among the most adept users of camouflage. They rely greatly on expert camouflage to assist them in carrying out that portion of their role involving prolonged periods of activity deep into enemy territory.

It should be noted that while jungle or tropical camouflage has received the greatest amount of emphasis in recent years, conventional or European type camouflage doctrine is also covered in Australian Army courses of instruction. Obviously however, there are just fewer opportunities to employ this type of camouflage in the tropical environment of the Pacific Southwest.

Having served a tour in Vietnam, Major Sarah recalls a Republic of Vietnam "battalion sweep" on which as an observer, he witnessed a classic example of how not to camouflage. He says that the six foot-six inch advisor to the unit wore a shiny, red and yellow lacquered helmet which bobbed along the horizon, visible for miles. The battalion commander's jeep was garnished with the unit insignia and adorned with numerous antennae. The major added that many of the troops on the sweep carried transistor radios which blared away. He recalls being amazed at the lack of attention to camouflage and sound discipline. However, the unit still captured six enemy soldiers during the sweep.

When asked if the Vietnam experience changed any views the Australian Army may have had on camouflage doctrine, Major Sarah replied that it had not. He says their jungle camouflage doctrine was well developed before Vietnam entered the picture and the lessons there merely reinforced existing practice.

FRANCE

One of the first points made by Lieutenant Colonel Henri C. Aiglon was the importance of individual training with reference to camouflage employment. The colonel says the use of camouflage should be automatic—troops should know how to camouflage and begin to do so even without word from the commander. His example of the proper troop response was related to his experiences in Vietnam in the early fifties. At that time he was a young Engineer platoon leader attached to a Foreign Legion Battalion. His unit took heavy enemy fire as they were crossing a rice paddy and immediately his men began digging in with entrenching tools, improving their positions. His point of emphasis here was that no order was given by him to dig in. The men had the proper training, knew what to do, and responded accordingly. So it should be, he continues, with camouflage employment.

Colonel Aiglon concedes that proper camouflage utilization can be boring and exhausting work, but it must be done. And a good commander will see that it is done. In the French Army, camouflage is regarded as a "reflex and fighting attitude" of individuals and crews, says the colonel. In other words, camouflage should be pursued with as much vigor and attention as security, maintenance of weapons, or sound and light discipline.

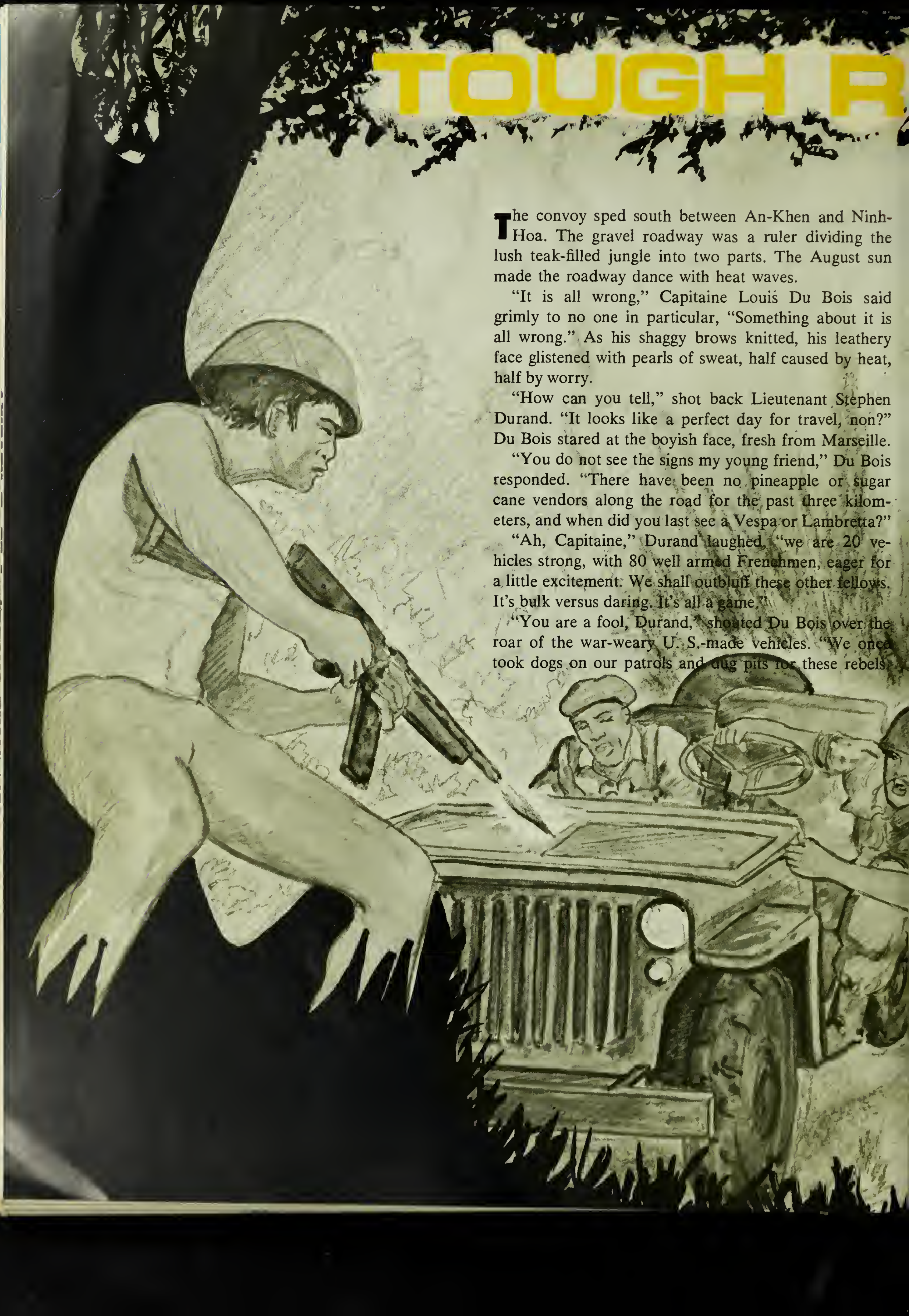
This is not to say that individuals and crews are the only area to receive emphasis in French camouflage doctrine. On the contrary, at the Army Corps level entire platoon and company size camouflage units can be found. However, greater emphasis is placed upon individual skills than with units as a whole.

On the topic of camouflage equipment used by his country's forces, he replied that it is basically quite similar to that used by the other NATO nations. For example, the "barracuda" net, utilized to cover vehicles and field artilery pieces, is of Swedish design, but is licensed for construction and use in France and several other countries.

The colonel discussed camouflage with reference to the three basic types of warfare: A conventional, European theater war; a guerrilla war; and lastly, a nuclear war. In the first two cases, the historic use of camouflage is obvious—it can be of tremendous importance. In the third, the nuclear war, camouflage "does not fit" in the classic sense, says the colonel. If a troop concentration or other significant target is detected, in less than two and a half hours a tactical nuclear warhead could be launched on the location. In such a case, mobility may be the best means of avoiding detection.

Finally, in the area of detection. the colonel adds that the development of sophisticated sensors by the hunter, and in turn, electronic countermeasures by the hunted, have greatly altered the state of the art. Thus it is expected that electronic detection will make the employment of camouflage in future warfare a very volatile situation.

TOUGH R



The convoy sped south between An-Khen and Ninh-Hoa. The gravel roadway was a ruler dividing the lush teak-filled jungle into two parts. The August sun made the roadway dance with heat waves.

"It is all wrong," Capitaine Louis Du Bois said grimly to no one in particular, "Something about it is all wrong." As his shaggy brows knitted, his leathery face glistened with pearls of sweat, half caused by heat, half by worry.

"How can you tell," shot back Lieutenant Stephen Durand. "It looks like a perfect day for travel, non?" Du Bois stared at the boyish face, fresh from Marseille.

"You do not see the signs my young friend," Du Bois responded. "There have been no pineapple or sugar cane vendors along the road for the past three kilometers, and when did you last see a Vespa or Lambretta?"

"Ah, Capitaine," Durand laughed, "we are 20 vehicles strong, with 80 well armed Frenchmen, eager for a little excitement. We shall outbluff these other fellows. It's bulk versus daring. It's all a game."

"You are a fool, Durand," shouted Du Bois over the roar of the war-weary U. S.-made vehicles. "We once took dogs on our patrols and dug pits for these rebels

W TO PLOW

John W. Savage, Jr.

The rebels put cats in the traps. The dogs barked. We thought the rebels were trapped and closed in. Then they closed in on us. That my friend was a game."

"You worry too much," laughed the brash lieutenant as he smoothed the cool barrel of his M.A.T. 49 submachine gun. "My pet and I will take good care of you."

Seven kilometers further along the road and DuBois' fears would be confirmed and Durand's jests would be forever stilled in a fusillade of bullets and mortar fire that also would take the lives of 23 other brave Frenchmen. Durand did not realize that his enemy, the Viet Minh, had not only daring on their side, but bulk, too—bulk in the form of the lush vegetation that grew up to the roadside of this verdant country, this Viet Nam. Bulk that could conceal many things—sunlight, animals, Viet Minh, ambush and death!

The French in their war in Indo-China were hampered by many things, one of which was the overabundance of trees. Cashew, Mango and coconut and thousands of other types grew thickly to plague the French. Kapok, Mahogany, and Rubber trees also blossomed profusely in wild abandon. Trees short and trees tall, trees thin and trees thick, they all grew together forming a roadside morass that the Viet Minh used to set up hasty ambushes and then just hastily fade into them. As ambush begat ambush, the remote outposts began to fall into enemy control. And as these outposts fell, so did the French control on the population in these areas.

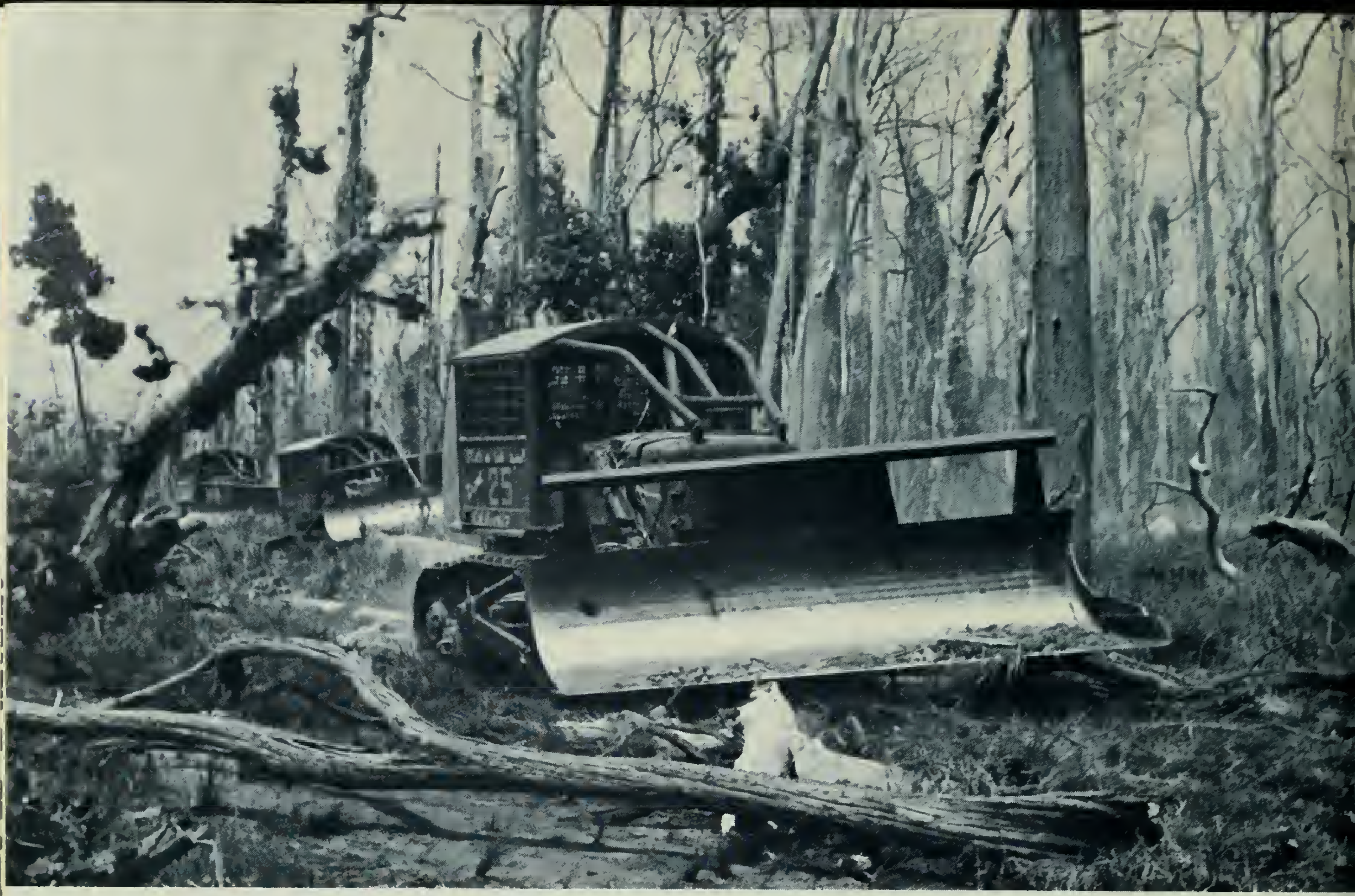
As the French were losing their control and American aid was increasing, the problem was pretty well stalemated. Then the American soldier began to make his presence known and found himself vulnerable to the same tactics used against the French. The Americans, however, found an elective countermeasure—air superiority. This seemed to alleviate the problem of resupplying the GI outposts. Although supply routes established by air proved effective, the civilian population suffered due to the fact that their major supply routes still remained in enemy hands. As long as the Viet Cong, as they were now referred to, had this control, they were free to confiscate materials that were being transported to market. This created a two-fold problem: one, open the roads for military resupply and two, civilian trade and travel. This problem was solved by a modern adaptation of an old land clearing device—the plow!

Webster's new Collegiate dictionary defines a plow as, "an implement used to cut, lift, invert, and partially pulverize soil." But Webster's explanation only vaguely fits the description of the plow used in Vietnam. For one thing, this plow has a blade that cost approximately $4,000 dollars when it was first introduced and the power behind it $40,000. If you have not guessed by reading this far, it is the renowned Engineer Corps superweapon—FSN–3830–933–5458, MDL, KG7EM, Treedozer, affectionately known as quite simply, "Rome Plow."

Named after the Rome Plow Company of Cedartown, (not Rome) Georgia, which manufactures this renowned blade, it is specifically a tractor attachment that features a projection or "stinger" which punctures a tree and causes it to split. This makes it easy for razor sharp bottom blade to cut into the tree as the power unit, more often than not, a D7E bulldozer, pushes the tree over. With this "stinger" and "slicer" operation, even the largest tree lasts only a few minutes against the onslaught. As as result the Rome plow is capable of leveling any kind of jungle without appreciably disturbing the supporting soil as long as the soil condition will support the equipment.

Hailed as a new concept in warfare, the powerful plows with their Engineer crews have been credited with depriving the enemy of his former safe havens while creating areas more susceptible to the Vietnamese government control. As an added benefit, the Rome plow has been cited by U. S. pacification officials as offering the war-weary refugees a fresh start on life in the cleared land.

The phenomenal success of the Rome Plow can be laid to the effectiveness with which it works. One steel-cabbed tractor, equipped with a Rome K/G clearing blade can clear and level an average of one and one-half acres per hour, conditions permitting. This means an average 100-man, 30-plow team can churn through the jungles accomplishing an overall flattening effort of 10 acres of jungle per day, per machine. It also means that the plow operators start crashing through the jungle around 7 a.m. and stop roughly by 4:30 p.m. For the



Here is a close-up of the "stinger" in action, a tractor attachment on the "Rome Plow" which stings and slices large trees. The 4,600-pound blade attached to this "Rome Plow," simply tears through the tree.

These "Rome Plows" sweep trees, heavy undergrowth, and rubble out of their way as easily as a hot knife cuts through cold butter. They represent a new concept in warfare and give the combat engineer a big assist in his quest to clear enemy-infested jungles that were considered safe havens in the past.

next couple of hours the hot blade is sharpened to a fine edge with a special grinder.

Then the maintenance crews go to work on the bulldozers themselves. This means they sometimes work all night to get the machines ready. The whole cycle begins again the next day. Living in the jungle, in a self-made clearing, the engineers have few of the creature comforts afforded to other fighting units. However, comfort is not their only problem.

The enemy looks upon the Rome Plow with an appropriately jaundiced eye. They zap away at them with rockets and sniper fire. They booby-trap tree branches with grenades and lay mines in the operators paths. Still the plows go on, stripping 200 to 400 feet of timber from the roadside. They continue to cut broad strips through the woods so that Armored Personnel Carriers can race to enemy base camps that are freshly exposed. They level fields of fire around cantonments. They cut down the enemy's bulk!

When the final tabulations roll in on this war, the Rome Plow will have proved itself an effective weapon against a phantom enemy. It will have also been a contributing factor for saving countless lives.

Captaine DuBois would have like that. Au Revoir.

COLOR ME CAMOUFLAGE

Lieutenant Colonel E. N. Jones

Gotta' minute, Soldier? Have you ever been caught in a embarrassing situation or in a place where you shouldn't have been? What'd you do? That's right—exactly what the normal person would do; "color" the situation to make it look like something other than it is. Your purpose—Make yourself less conspicuous, or in other words, blend into the background. That, Soldier, is called camouflage. You did it naturally. Why? Because *you* were directly involved!

Now let's apply the same logic to *you* in your everyday activities in the field, and you know what? *You* are directly involved, *you* should attempt to blend into the background, *you* should be less conspicuous, *you* should do this naturally, but some how, for your reason, you don't And you know—it just doesn't make sense, because *"your hide"* is at stake! You're right if you've decided that what I'm saying is—you and I are lousy in our practice of camouflage in the field.

Let's take a look at a recent report written around observations of camouflage, as you and I practice it in the field. During the spring of 1972, a camouflage team from the US Army Mobility Equipment Research and Development Center, Fort Belvoir, Virginia, observed some field exercises conducted by combat units. The team's purpose was not only to provide technical assistance to the troops on camouflage practice, but also to evaluate the effectiveness of the Army's camouflage materiel and doctrine. To be perfectly frank, you and I didn't "place" too well! Without exception, each individual could have improved.

Even though you personally may practice camouflage to the Nth degree and you are so well blended into the background that "daylight has to be piped to you," remember one thing! Camouflage is not just an individual effort, but a team/unit effort, because that's the way we get our job done. Every member of the unit does his share of the unit effort. Of course if "Old Hoss," your die-hard, faithful buddy doesn't camouflage, he sticks out like a sore thumb and exposes the whole unit's position or activities. Then you become directly involved. So it behooves you and everyone else in the unit to "get with Old Hoss" and straighten things out.

Okay, so you're probably thinking about now that maybe there is something to this "camouflage thing" since you are involved. *You* probably didn't receive a lot of instruction on camouflage during BCT. If you want a little self-education get copies of FM 5–20 and TM 5–200, and read them. There's nothing magic or complicated about camouflage. You just have to use a few simple principles and apply common sense.

To bring you up to date with what's going on in the camouflage program, it's worthwhile to mention a few things. The Army is looking hard at camouflage, and needless to say, a "prod" to get things moving is underway. School training circulars are being revised, commanders are emphasizing, and new equipments are being developed. If you haven't felt the impact in the field yet, you will. The push is forthcoming. So you say to yourself—so Department of the Army is concerned, they're going to put the "pressure on" and get on with this camouflage "kick"—so what? Well—if you'll pause for a moment and look at the situation from a practical viewpoint, pose an answer to this question, "Where should the camouflage "push" come from?" Remember the enemy doesn't like you and the next time he sees you, he aims to do something about it! So—pardon me. Think I'll blend into the background, because I am involved. Wanta' join me? And by the way, believe I'll check on "Old Hoss" too, because he involves all of us!!

Lieutenant Colonel E. N. Jones, is the former Chief of the Materiel Division, Combat Developments Command Engineer Agency. He is a veteran of both the Korean and Vietnam Wars and has been an Army aviator for 19 years. A graduate of Georgia Tech, the colonel's basic branch is the Corps of Engineers. He has held a number of engineer assignments throughout the world, including a tour of duty as a staff officer in the Office of the Chief of Engineers. Colonel Jones is currently assigned to the Defense Intelligence Agency in the Pentagon.

THE HELPFUL WIDOW

ENGINEER STAFF

From Black Widow spiders to delicate optical instruments to an inspired sense of self-confidence seems a strange path, but students of the Topographic Instrument Repair Course at the U.S. Army Engineer Center, Fort Belvoir, Virginia, follow it regularly.

Newly arrived students for the 12-week course often find themselves overwhelmed at the thought of learning to dismantle, repair and reassemble the levels, transits, alidades and other sensitive optical instruments used in surveying, charting and mapping, but several of the instruments lend themselves to shoring up wavering confidence.

A number of them contain a spider web cross-hair in the "eye-piece" to aid in accurate readings over long distances. Course instructors have discovered that successfully mastering the seemingly impossible technique of obtaining enough suitable web, washing, and finally installing it accurately in tiny grooves, convinces the average student that he is capable of handling the most intricate repair steps.

There is an additional, practical aspect, too—having proved to himself that he can do it, the student is ready to tackle the job in the field, complete with safely coaxing enough web from the nearest Black Widow.

Although the school does not rely on local production of all the web needed for the exercise, two or three of the shiny black spiders are kept in glass jars at all times, well fed on a diet of crickets. Since the Black Widow is poisonous and considered dangerous, at least two people must be present when one is handled. When web is needed, the spider is placed on a pointer or other long implement and encouraged to drop down, suspended by her web.

The web is then transferred to a spool, which is turned by hand to take up the web as the spider spins. When enough web has been obtained, the spider is returned to her home; the web is then washed with acetone and either installed in an instrument or stored.

Black Widow web has been used for many years in instruments because its unique monofilament structure is smoother and retains its shape better than the cable-like polyfilament web of other spiders. Web cross-hairs nearly 80 years old are still in use.

Although modern optical instruments now have etched glass cross-hairs instead of Black Widow web, the tiny strands, over 100 times the strength of a similar strand of steel, still serve to keep many excellent instruments operating, and to weave a background of self-confidence for each succeeding class of students.

Hail to the Black Widow!

The Black Widow spins a single strand of web as a safety line in the adjacent photo. In the two photos (lower right, page 17), first a student examines a spool of newly collected web before beginning the next step. Then, tiny strands in minute grooves are placed in the reticle.

A student takes the final step as he puts the reassembled instrument through a post-overhaul checkout under the watchful eye of an instructor. By now he feels that delicate screws, mirrors, gears, and lenses will be no problem, since he has actually installed a spiderweb and made it work.

COMBAT SECURITY—CAMOUFLAGE

ENGINEER STAFF

Remember that old childhood game—Hide and Seek?

Well, that about sums up the objective of military camouflage. If the enemy cannot find you, he is in trouble. This, however, is not a simple task. Today, advances in remote sensing systems and information processing have made it necessary to counter those surveillance means in order to reduce the vulnerability of targets and target complexes.

The Army has placed little emphasis on camouflage for many years but a major effort is now underway to change that. Just 10 months ago, the U.S. Army Materiel Command (AMC) designated the U.S. Army Mobility Equipment Research and Development Center (MERDC) at Fort Belvoir, Virginia, as the lead laboratory for camouflage technology.

Since that time, the Center's effort has included camouflage against all militarily significant approaches to remote sensing, particularily the electromagnetic spectrum from ultraviolet through radar wave lengths. Active measures intended to jam, interfere, or otherwise render ineffective the remote sensing means or its transport are excluded from this definition.

Camouflage technology has been defined by Center experts as a science that is required to minimize the probability of detection, identification and location of personnel, structures, material, and terrain features, including spoor, through passive means of hiding, blending, disguise, and simulation.

In its role as lead laboratory for camouflage technology, the Center has instituted a vigorous effort to assess the vulnerability of AMC systems and to reduce their vulnerability by building camouflage features into equipment design. This includes measures on existing equipment, where practicable, but is aimed primarily

A typical camouflage exercise is being performed during project MASSTER.

Here are two excellent examples of camouflage.—A two and a half ton truck under four Sullivan Nets during *Lanyard* test (above) and a desert type pup tent covering.

at the long-term development items. A concerted, Center-funded, AMC-wide start on this "built-in" camouflage effort was initiated last May.

A countersurveillance analytical tool for categorizing targets, as a function of signature, was developed under contract with the Stanford Research Institute. This computer model predicts the vulnerability of targets and the effectiveness of camouflage treatments relative to the various sensor threats. The model is being exercised and refined in-house on a Combat Developments Command 6600 computer. Sub-routines are being added to determine the effect on terrain massing, to perform cost effectiveness evaluations, and to provide a graphical read-out capability.

Two computer programs have been developed in-house to aid in design of camouflage material. One, the Photomatch program, is being tested to predict the response of camouflage colorants to spectrozonal photography, which will minimize the need for field evaluation of development materials. The second, the Colormatch program, will enable computerized formulation of camouflage colorants to meet any desired spectral characteristics, and thus eliminate the inefficient "cut and try" process formerly required in color development. Preliminary results, using a base of 18 pigments, have been verified for blends in the visible spectrum. The program is being expanded to a base of several hundred pigments and to cover the near infrared spectrum as well as special camouflage spectral characteristics.

The Center is participating in a joint North Atlantic Treaty Organization (NATO) program to assess the vulnerability to detection and identification of military equipment, and measure the effectiveness of camouflage treatments. The effectiveness of progress levels of camouflage will be evaluated as a function of cost and effort. The plan is being coordinated with NATO countries for implementation during Fiscal Year 1973.

There has been progress. An experimental far infrared camouflage system for concealing heat-producing targets, such as generator sets, has been demonstrated successfully. It is a modular system and will incorporate visual and radar camouflage characteristics to provide a broad spectrum concealment.

Also, the Macroscope, a compact, indoor radar test range, began experimental operation in 1972. With use of 1/10 scale models of targets, the frequency is scaled to simulate operational radar sensors. This provides a detailed target signature analytical capability and minimizes expensive, time-consuming field measurements. Measures for signature suppression were studied to provide input to prototype developments by other AMC laboratories.

There have been other successes. A model of a foam simulator has been developed and demonstrated successfully. The concept is a compressible foam, which can be rapidly molded to the configuration of the archetype target item and vacuum packaged to less than 1/10 original bulk for storage and transport. The item recovers original bulk and configuration when unpackaged. The Land Warfare Laboratory (LWL) conducted experiments for the Research and Development Center on ground mobilization of helicopters for camouflage siting. The LWL also made progress on reduction of glare from helicopter cockpit canopies and rotor blades.

A demonstration of the state-of-the-art camouflage capability was conducted at MASSTER (Mobile Army Sensor System, Test, Evaluation and Review), Fort Hood, Texas, during exercises one year ago. The exercises pointed up the camouflage problem of the field army. As a result, MASSTER exercises are being planned for troop indoctrination on camouflage practices, and for devising, testing, and evaluating new camouflage techniques and material. The Center has established a team on-site to provide a continuing quick reaction capability to meet new camouflage needs as they are identified in the MASSTER exercise.

Other actions include development of a complete camouflage system for the Hawk missile system. The system is expected to be rapidly deployable and compatible with Hawk operations. Additionally, a new camouflage screening system will replace the obsolescent burlap-garnished, cotton twine netting. The principal components of the system are a basic hexagobal net covering 900 square feet and a diamond-shaped filler net to maintain symmetry when two or more hexagonal nets are joined. It is fabricated of polyester garnished with polyvinyl chloride coated spun-bonded nylon, each being equipped with quick connect-disconnect devices to permit rapid emplacement and removal. Two basic and filler nets can be joined in five minutes, with additions in less time.

One module, including basic and a filler net and a repair kit, weighs 50 pounds with carrying case. It is designed to provide concealment from visual, radar, photographic, and near-infrared detection. The screening system will be provided in color combinations for use in woodland, desert, and snow areas. It is reversible to adjust to seasonal and color differences existing in nature.

In addition to easier and more rapid handling than the large assortment of sizes, shapes, and color blends found in the current standard burlap-garnished cotton nets, the new system also offers advantages in durability and resistance to water and oil absorption.

The woodland blend completed engineer testing last March and currently is undergoing service tests in Panama. A contract was awarded in 1972 to develop a process for quantity production of this new lightweight camouflage screening system.

CAMOUFLAGE, CAMOUFLAGE WHEREFORE ART THOU, CAMOUFLAGE?

Captain G. W. Gipe

Camouflage is one of the tools of warfare which, when properly planned and implemented, can save lives and win battles. Sun Tzu, Chinese philosopher of 25 centuries ago, recognized that when he said, "All warfare is based on deception . . . When able to attack we must seem unable: When using our forces, we must seem inactive: When we are near, we must make the enemy believe we are far away."

Alexander of Macedonia also recognized it when he used camouflage and deception to cross the Hydaspes River and defeat Porus in 326 BC.

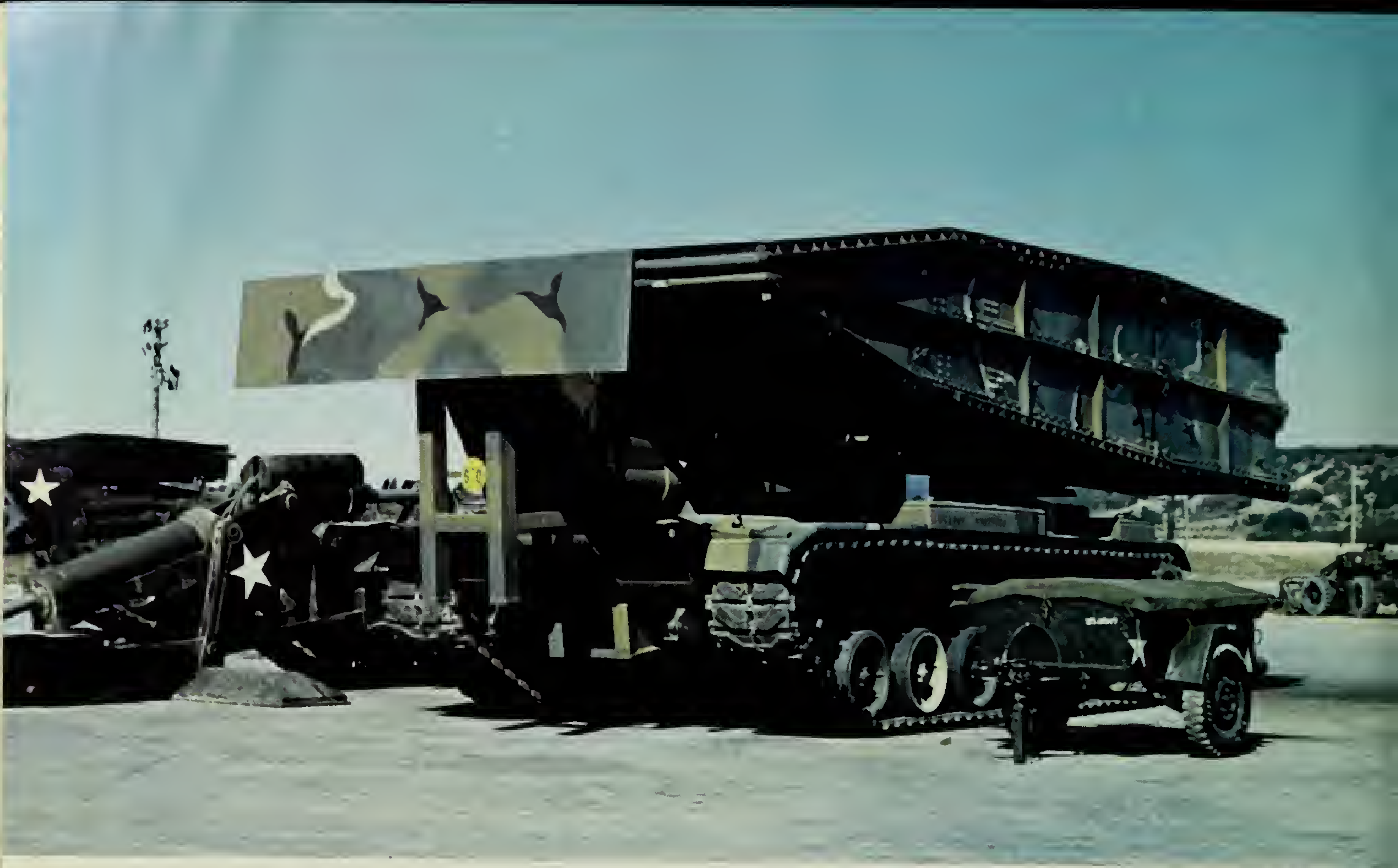
World Wars I and II both contain numerous examples of camouflage operations such as Operation Exploit, a deception operation in which engineers were required to construct and occupy a decoy bridge park filled with dummy materials in preparation for crossing the Rhine.

In Korea, camouflage was used to a lesser extent. Then, in Vietnam, camouflage was virtually ignored.

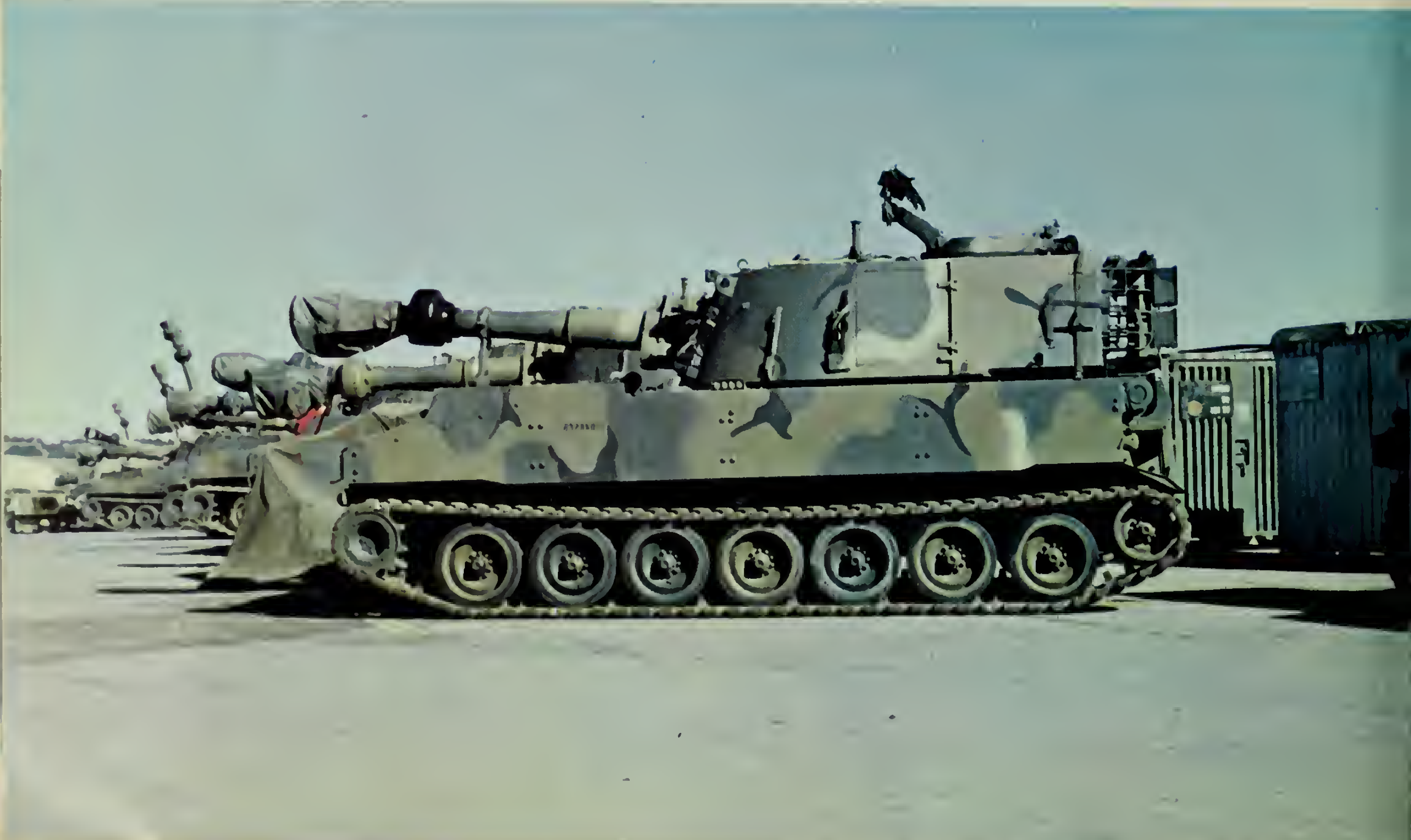
Does this mean camouflage is no longer necessary? Quite the contrary. In Vietnam, air superiority was never in question so enemy air observation was not a problem. Because the enemy threat was from infiltration as opposed to air power, we not only did not camouflage our base camps, we did everything we could to eliminate the camouflage we had by stripping large areas surrounding those bases.

In future wars, we may not have the luxury of air superiority. Instead of base camps, large scale, highly mobile land forces will move constantly, quickly establishing and breaking bivouacs. Because air superiority will not be assured, the enemy observation threat will have to be countered. This is where camouflage becomes important to the tactical commander.

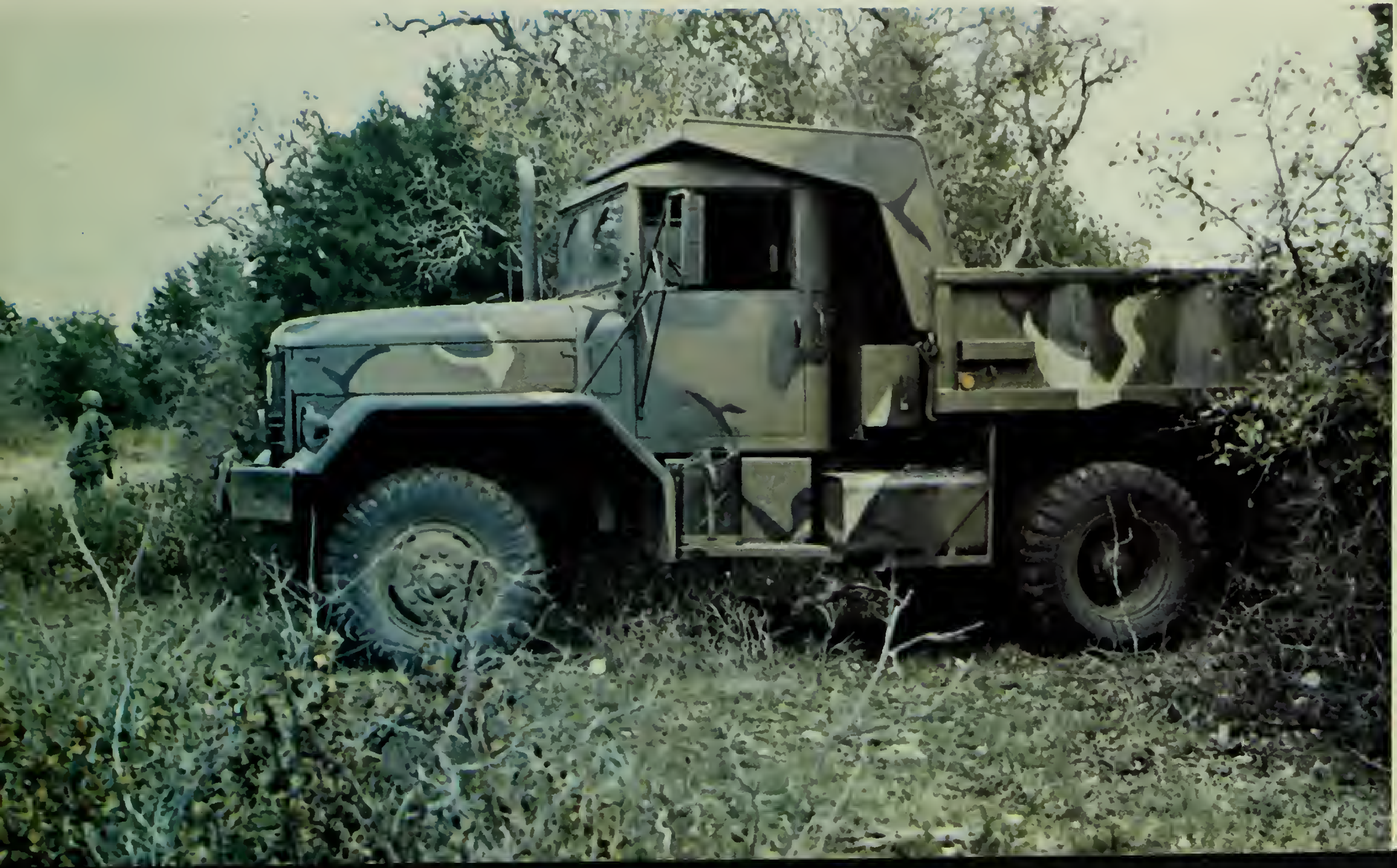
Camouflage is defined as providing the enemy with visual misinformation. The engineer has a unique role in camouflage. Not only is he responsible, as all commanders are, for the camouflage of his unit, but he is also responsible for providing technical advice and assistance to the units he is supporting. For instance, FM 5–1, Engineer Troop Organizations and Operations states that "engineers advise and assist other



Patterned Painted Equipment of the 17th Eng Bn, 2nd AD,



't. Hood, Texas, which was utilized during Project MASSTER.



troops in utilization of natural features which will aid in camouflage and concealment. . . . Engineers may install and move decoys, fabricate disguises, and construct covered routes and positions."

This means that as the camouflage experts, the engineers could be called upon to evaluate routes of advance from a camouflage point of view, advise commanders on dispersion and time required for camouflaging, write camouflage plans and Standard Operating Procedures (SOP's), construct dummies and decoys, and plan the camouflage of large installations such as supply dumps, air fields, and POL tank farms.

Prior to the late 1960's many of the highly technical tasks might have been assigned to an Engineer Camouflage Company. This organization was designed to train the units it supported to plan and construct the camouflage for installation and to inspect and advise supported units on camouflage discipline and training. The last Camouflage Company was deactivated in the 1960's.

If you could not find an Engineer Camouflage Company, you might have been able to find a Camouflage Specialist (MOS 51E) who could assist in the more technical aspects of camouflage. Unfortunately there are only a handful of these individuals left in the Army.

If you could not come up with a Camouflage Company or Camouflage Specialist, you might have been able to find a few camouflage nets. However, due to the decreased emphasis on camouflage during the 1960's very little new camouflage equipment was produced. For the most part existing nets have become unservicable through use or lack of it. With a few exceptions, the nets have become almost as rare as the Camouflage Specialists.

All in all, the picture is not very bright. So what is being done about camouflage now? Increased interest in camouflage at the highest levels is being felt throughout the Army. Several proposals are currently being studied at the Department of the Army level. If adopted, they will have a significant impact on the camouflage program. Among these are proposals to pattern paint all tactical vehicles, issue camouflage uniforms as standard for selected units and modify existing Tables of Organization and Equipment to require selected battalion-size units to have a trained camoufluer on its staff. These individuals would be trained at Fort Belvoir, Virginia, and identified by a Military Occupational Specialty prefix.

Another proposal is to increase the camouflage instruction that is being presented at the various service schools. At present, the Engineer Officer Advanced Course at Fort Belvoir receives no camouflage instruction. And the Officer Basic Course there offers only one hour. The Engineer Noncommissioned Officer Advanced Course gives two hours and the NCO Basic offers five.

Work also is being done in the area of materials. The Mobility Equipment Research and Development Command (MERDC) at Fort Belvoir, is currently testing a "Light Weight Screening System." This plastic and nylon net will replace the old burlap-garnished cotton twine net. In addition to being lighter in weight, the net can effectively defeat most types of radar and photographic infrared.

At Fort Hood, Texas, the Modern Army Selected Systems Test Evaluation and Review Center (Project MASSTER) has been tasked with assisting in developing and evaluating new camouflage doctrine, techniques and materials in coordination with Army Materiel Command, Combat Developments Command, and the Continental Army Command. To do this, the 2nd Brigade of the 2nd Armored Division and the units supporting the brigade, are in the process of pattern painting their vehicles. Elements of the brigade have been issued German and US modular camouflage nets that are currently under development.

Limited numbers of camouflage uniform tunics and individual camouflage nets also will be issued. Some fairly exotic equipment also will be demonstrated. A plastic foam dispenser that can be used to change the shape of objects has stirred interest. Another interest grabber is the terrain reflector. This device is used to reflect the terrain between the observer and the camouflaged object.

What is the purpose of all these tests and demonstrations? They should provide answers to some very basic questions about camouflage and camouflage doctrine. Questions like—Should you try to use camouflage nets in a highly mobile environment or is the time lost in erecting and dismantling the nets not worth the added camouflage? If you do carry nets on tanks, where do you carry them? How do you camouflage a helicopter? How much training does the individual soldier really need? Where does camouflage fit on a highly mobile, rapidly changing battlefield of the future?

While these and other questions may not be totally answered at Fort Hood, a start will be made. The results will have far-reaching effects on the Army, and particularly the Corps of Engineers, in the years just ahead.

What Sun Tzu said 2,500 years ago still holds true!

Captain G. W. Gipe is currently serving as an instructor and branch chief in the Field Engineering Branch of the Department of Applied Engineering at Fort Belvoir, Va. He is a Distinguished Military Graduate of the University of California at Berkeley. The captain has served two tours in Vietnam and is a graduate of the Engineer Officer Advanced Course.

A BACKBONE FOR THE BARRIER SYSTEM

THE INSTANT OBSTACLE

Robert B. Bockting

This article elaborates a concept that could one day make a contribution in the field of barriers. Whether you readers accept it or not is beside the point. He offers this free thought to you so that it may attract consideration as a solution to part of the problem of frontier defense.

The tanks roar westward on the autobahn at top speed. Their thrust gains nearly complete surprise, ending the tension of the past few days. Up ahead, flanking a defile, stands an odd, tower-like concrete structure. Let us call it a Topple Tower. There is a flash at its base and an explosive thud. With that, the structure crashes across the roadways. Amid the dust it appears like a huge cheval-de-frise. The armored column slows, its mine plows and assault bridges useless against this massive barricade. The sappers will have to try to blast this one; or, in time, they may reduce it with gunfire. Meanwhile, the tank column is stopped.

The menace of surprise on a threatened frontier is not new. No defender can afford to keep all his forces poised and alert everywhere, indefinitely. The antidote, historic and present, is the physical barrier. The ditch and sharpened stakes which blunted the rush of Teutonic warriors on temporary Roman camps evolved into the moats and walls of medieval Europe and the engineering marvels of Vauban. Obstacles (usually fences, ditches, and walls) have helped hold attackers at bay since before recorded history. Some have held for a few days, some for centuries.

Today, many countries of the free world have potentially hostile frontiers at which tactical surprise could prove decisive. Prominent among these are West Germany, Greece, Turkey, Israel, and South Korea. All face the threat, and some have experienced invasion in the recent past.

The communist invasion of South Korea in 1950 achieved a measure of tactical surprise. Despite the mountain barriers in much of the area, enemy columns spearheaded by a few score tanks advanced rapidly along historic invasion corridors. They shattered much of the deploying Republic of Korea Army north of the Han River and in a few weeks had chased the remnants to Pusan. In 1968, the Soviet Army and other Communist Bloc forces dashed into Czechoslovakia so quickly that resistance was out of the question. The degree of warning versus surprise experienced in that instance is probably typical of that to be expected in Central Europe.

There is no guarantee against a renewal of this attack nor against a surprise invasion of any country bordering the iron curtain. In no instance can the readiness of forces alone suffice to counter the advantages inevitably accruing to the aggressor. By the same token, natural barriers alone, however formidable, have proven inadequate. The challenge to today's military engineer is to devise a barrier system to counter as far as possible the attacker's advantages. The modern barrier system must be primarily effective against tanks and armored vehicles and must overcome the element of surprise and the consequent lack of time for barrier construction and force deployment.

The completion of an effective system using current obstacle types requires several days, the efforts of many hundreds of men, and the transport of vast amounts of material. This virtually precludes the construction of a conventional barrier of effective proportions after an attack materializes. The obvious alternative, that of pre-hostilities construction, has serious limitations.

Currently, the most prominent antitank barrier component is the minefield. However, minefields emplaced in peacetime are a decided liability. They render considerable areas hazardous. They deteriorate in effectiveness, and are expensive and dangerous to maintain.

While a minefield will disable some of the vehicles which attempt to cross it, this does not always stop a tank attack. How, then, can an armored column, striking by surprise along an autobahn or through an open valley, be stopped?

The Topple Tower is a promising innovation. The concept consists basically of a series of reinforced concrete towers with chambers for explosives built into their foundations. These are constructed singly or in groups at suitable locations so that when felled they form a barrier. The towers are formed with projecting limbs, some of which (when the tower is felled) are driven into the earth to support and anchor the structure. The remaining limbs extend upward and outward increasing the height and width of the obstacle. The illustration shows the basic tower in both the standing and felled positions.

In its preferred form, the tower is usually some 75 to 100 feet in height. It is constructed in rather massive design, about six or more feet thick at the base tapering to about four feet at the top. Projecting limbs as thick as the tower at their roots and six to eight feet long are spaced in clusters of four at intervals along the tower. They extend radially from the trunk of the structure at right angles to the tower and to each other. Coils of barbed wire are integral with the structure to inhibit breaching.

The Topple Tower is not intended to completely supplant current obstacle types, but to be used as the basic ingredient of a barrier system including other types of obstacles. It is conceived as the backbone element of the system because of a unique series of features.

This obstacle can be installed in peacetime because it will last indefinitely, requires virtually no maintenance, and presents no hazard to persons or property. It removes an insignificant area of real estate from its usual economic use and presents no hinderance to movement until felled.

The Topple Tower is responsive to an emergency or crisis situation since it can be executed (felled) in a few minutes if an attack should be launched with little or no warning. By installing the explosives, it can be brought to a high state of readiness in the event of a period of political tension. If linked by wire or radio to a central control, several hundred of these obstacles can be readied for instant and simultaneous execution. To block defiles it may usually be used singly. For wide areas, the towers would be spaced in series so that when felled a continuous linear obstacle is formed.

The tower is characteristically more versatile than other obstacles since it can be executed safely near or within towns or cities with little danger to inhabitants or damage to property. The tower need not necessarily be felled by explosives. Its base may be so constructed that the structure can be toppled with a suitable jack. It requires no special release authorization or unusual precautionary procedures; presents no troop safety hazard; and needs no special weather, wind, or soil conditions.

It is a more effective obstacle than most types currently used in barriers since it cannot be crossed with assault bridging nor breached with mine plows or rollers. It can be used in multiples to provide a continuous lateral barrier or to increase the barrier depth.

Finally, it is a credible deterrent to attack and, by its nature, non-escallatory. When used in clusters, it can form a more formidable obstacle than a nuclear demolition, at a fraction of the cost, and with none of the inhibiting constraints.

The concept presented here is based on the innovation of an obstacle type which is untried and untested. It is so simple, however, that most aspects of its use are evident or calculable.

The free world nations which border iron curtain countries need barriers primarily to discourage aggression and, should that fail, to gain time for force deployment. This early delay remains as strategically vital today as it has proved repeatedly during the centuries from Thermopylae to Bastogne. Deterrence is enhanced by the potential attacker's knowledge that time lost at a barrier can cancel the element of surprise.

The system proposed is, up to this point, a skeletal one. Installed prior to an invasion, it quickly creates a barrier in the immediate vicinity of the frontier. Its purpose is to stall the sort of breakthroughs which led to the fall of France in 1940 and stunned the Egyptians in the Sinai in 1967. The skeletal barrier should prevent a blitz from gaining enough momentum to paralyze defending forces and keep them off balance.

This solves part of the problem, and the delay achieved with the Topple Towers permits the barrier zone to be expanded.

Barrier design involves selection of obstacle types and devising a method for their arrangement. Conventional barrier doctrine is well known, having been exhaustively restated for decades. Innovations in these tactics are needed.

Once an attack materializes, the full potential of mine warfare may be exploited. Let us explore some possibilities.

In Central Europe much of the terrain is wooded, with a network of forest roads which are easily passable to tanks. These areas are ideal for off-road installation of rocket type antitank mines. The ease of concealment of the mines is coupled with canalization of enemy vehicles. The rocket mine has a command fire option. A number of them may be set at intervals along both sides of a forest road. Fired in salvo, the effect on an enemy column should be devestating. Unlike many other weapons, command firing of mines does not disclose the firer. This "hornets nest" of off-road mines need not be limited to a single salvo. Moreover, the installation should include claymore type mines to be fired when enemy troops attempt to dismount. A cluster of these mines forms a better obstacle than either an abatis or crater. It requires less time to emplace. It is harder to detect by enemy reconnaissance and is a direct casualty producer. Being either controlled or readily deactivated by friendly forces, it does not inhibit counterattack. Sensors to detect enemy approach would enhance these tactics.

Now let us consider the unforested areas. Usually it is here that the most serious armored threat exists. Though the more critical defiles may be blocked by Topple Towers, they should be reinforced. Minefields are the best obstacle for this purpose, but the speed of their installation must be increased. Time cannot be spared for burying mines. Instead they will be distributed on the surface from a vehicle or scattered by other means. Nearly all agricultural land is sown habitually in some form of cover crop, if only to prevent soil erosion. Suitable camouflage crops should be grown deliberately in potential minefield sites. Hay crops, either standing or mown would provide good camouflage.

In proper season, grain crops or soy beans are likely candidates. This will permit much faster installation of mines and a suitable camouflage at each location.

The Soviets have excellent training and equipment for minefield breaching and river crossing. An improved friendly barrier technique must include methods for countering these enemy specialties.

Soviet units breach minefields with a heavy roller or set of plows attached to the front of a tank. The mines are detonated either beneath the roller or in front of the plows. The roller is massive and rarely sustains damage. When it does, its parts are readily replaced. The plows usually remove pressure fused mines without detonation. Here again, the rugged construction of the plows usually limits damage if detonation occurs.

A simple method of defeating these plows and rollers is available using standard supply items. The technique is implemented as follows. In the forward edge of a minefield a number of antitank mines are fused and buried conventionally. These are each linked with detonating cord and blasting caps to two inverted shaped charges buried below plow depth. The shaped charges are located about four meters closer to the enemy side of the minefield than to the fused mines. They should be about four meters from each other to assure that one of them will be detonated beneath the tank as the roller or plow initiates the fused mine. A pull fuse is added to the fused mine to insure that it will detonate if encountered by a plow.

For several years, the Warsaw Pact forces have possessed superior equipment and techniques for crossing waterways. Many of their vehicles are amphibians, and their battle tanks employ snorkels which permit them to ford all but the largest rivers. The limiting factors are bottom and bank conditions. These conditions make crossing sites predictable and permit countermeasures. Mining of banks and approaches would have obvious advantages. Command detonated mines appear promising if fired in salvoes. More important, however, are the advantages created for the use of flame foulgasses and similar flame devices. Swimming vehicles and snorkeling tanks are particularly vulnerable to flame attack. Restricted crossing zones and slow speed inhibit evasive maneuver. Flame fuel spreads well on a water surface, while stream banks concentrate its effects and hamper the enemy's escape.

In summary, severe time limitations will dictate future barrier techniques. Doctrine can no longer be based on causing enemy attrition by the conventional mass use of mines. We cannot afford to mine all approaches, but only those that are small or restricted. Mines should be used habitually in close association with other weapons systems and usually as part of an ambush. Mined areas should be sited to set-up the enemy force for destruction by preventing his maneuver under fire and restricting his withdrawal. As often as possible, the use of mines should be associated with at least a local counterattack.

The tactics proposed here emphasize concentration of action at a given time and place for greater shock effect. Command detonation affords selectivity between friend and foe, allowing unobstructed friendly maneuver. The advent of sensors increases the opportunities to use command initiated mines, coordinated with other weapons and counterattack.

The philosophy underlying these concepts stems from traditional western military thought and training which stress the ideal that an enemy should be defeated by a decisive act rather than by a strategy of gradual and cumulative attrition. The proposals attempt to offset the effect of surprise, to counter other known enemy advantages, and to increase barrier effectiveness at reduced cost.

Robert B. Bockting has served in World War II and the Korean War. He was a fighter pilot during WWII and was recalled in 1950 to see duty in Korea with the Second Infantry Division. Mr. Bockting retired from the Army Reserve with the rank of major in 1971. He has been a civilian employee of the Army Corps of Engineers since 1946.

DYNAMIC

It is gratifying to note that since word got out in the Fall 1972 Issue of **the engineer** that Army Training Program 5–35T had been drafted for testing in the Combat Engineer Battalion, Corps or Army, requests for that training publication have been steadily streaming into the office of the Engineer Dynamic Training Council at Fort Belvoir, Virginia. Hundreds of copies of the new ATP 5–35T already have been dispatched to Active Army and Reserve Component Engineer units worldwide.

The Council is extremely happy with this type of response from the field but now it is time to look at the other side of the coin and reflect. The Council urges you to send in letters expressing your candid opinion of the training value of ATP 35T, its strong and weak points, and what changes should be made. This is particularly important at this time since the U. S. Army Engineer School has recently embarked on a program to revise all of the Army Training Programs, Non-MOS Army Subject Schedules, and Army Training Tests.

The Fall 1972 Issue of **the engineer** also gave a preview of a few of the Council's survey findings. Since that time the Engineer Dynamic Training Survey Report has been completed and copies are being mailed to all company-size and larger Engineer units—both Active Army and Reserve Component. Here is an excerpt of the report's conclusions—

- Army-wide engineer unit training has seldom been "dynamic," and it has been noticeably declining in recent years.
- Major obstacles to achieving dynamic training in engineer units of the Active Army were personnel turbulence, non-mission support to higher headquarters, absence of personnel from training due to internal unit details or other commitments, non-training demands on unit leaders, shortage of skilled equipment operators, and reluctance of military authorities to use engineer troops on construction projects.
- Major obstacles to achieving dynamic training in engineer units of the Reserve Components were shortage of TOE equipment, deadlined TOE equipment, absence of personnel from training, non-training demands on unit leaders, lack of adequate training facilities, lack of reusable engineer materiel stocks, lack of adequate training budget, lack of time to prepare for training, and rigidity of the present training system.
- Areas not seriously impacting on training for the Active Army and Reserve Component Engineer units were lack of adequate training aids, safety restrictions, lack of emphasis by higher headquarters, and resistance to depart from traditional training techniques.
- The Active Army engineer trainers considered post support, small unit training and drug abuse as being "under-rated," and command inspections and race relations "over-rated" by the senior Army leadership as problems demanding the attention of small unit leaders.
- The Reserve Component engineer trainers considered community relations, small unit training, and drug abuse as being "under-rated," and command inspections and race relations "over-rated" by the senior Army leadership as problems demanding the attention of small unit leaders.
- Former Chief of Staff of the Army, General Wiliam C. Westmoreland's June 30, 1971 "Dynamic Training" guidance had resulted in only minor decentralization of training in engineer units worldwide at the time the survey was administered (February-May 1972).
- Individual training records were still being maintained in most engineer units at the time the survey was administered.
- Engineer units need a training noncommissioned officer.
- Engineer unit training would be improved if training materials were more available.
- There is widespread participation in civic/domestic action projects by engineer units Army-wide, with somewhat greater participation by Reserve Component units. There is a strong preference by both engineer troops and leaders for more civic/domestic action projects in lieu of normal training. Civic/domestic action projects are considered ideal for "dynamic" training, particularly by construction- type units.
- Troop construction projects are a good source for achieving dynamic training, particularly by engineer

TRAINING

construction-type units. Contractor/union objections to such projects are rare but military authorities appear cautious about using engineer troops on construction projects.

- Engineer units expressed the desire for more training/project time, with a corresponding decrease in time spent for other general military duties.
- Teaching how to teach small unit training has been neglected in service schools. Teaching methods and training management for small unit training should be incorporated at all levels in Army Engineer service schools.
- Active Army engineer units appear to have more flexibility in changing Army Training Programs (ATP's) based on their needs than Reserve Component engineer units.
- Field and technical manuals and locally prepared lesson plans are used far more extensively than other training publications such as Army Subject Schedules and USAES publications.
- The company commander is the on-the-spot training manager and is in the best position to foresee problems and supervise needed improvements in unit training.
- There has been a general loss of confidence since 1964 in the effectiveness of training and inspections. This was based on the response that inspections "sometimes or usually" contributed mainly to the better appearance (eyewash) of training.
- A significant percentage of those responding had never participated in a unit test or exercise. Only in Europe has there been significant unit testing below battalion level. Reserve Component units have participated more than Active Army units in FTX's and CPX's.
- Engineer training literature can be improved by putting all information for MOS study into one manual, easy-to-read handbooks on certain subjects, consolidation of some subjects into one bible, more pocket cards, and dividing FM 5–34 into a combat engineer and construction engineer handbook.
- Solutions that engineer Reserve Component units believe would improve small unit training include more modern TOE equipment, more money for training, paid time for training, changing the present ATP/ATT into a program designed only for Reserves, and less effort on projects and more on training during annual summer camps.

While there were few startling revelations, the Council believes that it has synthesized an accurate mosaic of the engineer training situation and the USAES already has initiated several actions to assist in improving engineer training based on the report's findings.

With the signing of the ceasefire in South Vietnam and the coming of an All-Volunteer Army, it becomes of signal importance that each engineer ask himself—"how can I help improve training, for training is the lifeblood of our units."

While the Council has identified those problems degrading training, it does not have all the answers that are needed to solve them. If you have an idea that might improve training, send it to the Council.

Another area where the USAES has been hard at work has been a union recognition program. Such a program will provide significant recruiting incentive for the Modern Volunteer Army, encourage the soldier to improve his skills in his trade, help commanders by providing a better basis for assigning new arrivals, and help in conducting on-the-job training programs. For instance, after protracted negotiations, a breakthrough has been made with the Initernational Union of Operating Engineers.

While initially the program only applies to MOS 62B, Engineer Equipment Repairman, it will be extended this year to all operator skills. Subject to successful negotiations with other unions it will then be extended to other construction and topographic engineer skills.

The spring issue of **the engineer** will contain fuller coverage of the union recognition program—so be on the lookout for it.

This article has been a potpourri of training items. It is hoped, however, that through this medium we have tickled your imagination to that point that you will correspond with the Engineer Dynamic Training Council. We are waiting to hear from you professionals in the field.

AN OVERVIEW

THE ENGINEERS ROLE IN DEFENSIVE OPERATIONS

Major Leroy A. Schmidt

Flagrant examples of improper employment of the engineer effort in defensive operations throughout the history of warfare are too numerous to mention.

Military commanders are well aware that inadequate or improperly employed engineer support can significantly reduce the chances of conducting a successful defense in a combat situation.

In every war there has been a requirement for the tactical commander to have a thorough understanding of the engineers role in defense. That requirement is just as important today as it was in the past.

Look where U.S. Army soldiers are today and why it is important that there be an awareness of defense. Our troops are currently deployed in a defensive posture both in Korea and in Europe. Also, although Vietnam was primarily an offensive action, the combat actions there were launched from a variety of defensive base positions. This makes it imperative that engineers thoroughly understand and advise their tactical commanders on the engineer's role in the defense.

So what fighting element of the U.S. Army ends up with the responsibility in a defensive operation? The basic fighting element is the division and it has two basic types of defensive operations—the area defense and the mobile defense. The primary differences between the two are the manner in which the forces are deployed and the size and the intended use of the reserve force. The division commander specifies the type of defense and the priorities of support construction.

The division engineer, who wears a second hat as commander of the divisional engineer battalion, advises the division commander on engineer support from employment of engineer troops of assigned and attached engineer units to barrier plans. He plans base development, advises on obstacle erection, mine laying, camouflage and Class IV supply requirements.

A divisional engineer company is the workhorse of the divisional engineer battalion. Each of the three line companies may be attached to or placed in support of one of the three brigades of an infantry division. In this capacity, the company commander is the "brigade engineer" and the company part of the combined arms team. The normal scope of support is for either an area or mobile defense in the forward area provided by the three line companies while the remainder of the battalion provides general support.

The primary mission of the divisional engineers in the defense is to increase the defensive capabilities of the combat troops by assisting in the organization of the ground, the preparation of the field defenses, and the movement of the reserves in the counterattack. In support of this mission, engineers prepare barriers and obstacles, demolitions and field fortifications. They also plan and lay minefields and prepare and maintain roads.

In organization of the ground, the engineers play a key role in advising and assisting other units in using and improving the natural defensive qualities of the terrain. This support includes the laying of mines, construction of artificial obstacles, camouflage, protective construction, and improvement of fields of observation and fire. It may include integration of barriers into the overall defensive plan to impede the enemy's progress, divert him into areas where he can be destroyed by fire and maneuver, or to separate attacking echelons.

Our research and development people, incidentally, have been hard at work developing aids to enhance the accomplishment of the engineer support mission. To mention a few, they have introduced the General Purpose Barbed Tape Obstacle, the Explosive Foxhole Digger, the Antitank Mine Dispensing System and the Overhead Cover for Foxholes. Let's take a look at each—

- General Purpose Barbed Tape Obstacle (GPBTO) was developed by MERDC as a rapidly emplaced, antipersonnel obstacle. The double-coil obstacle unit consists of two coils of barbed tape stored within a green polystyrne foam disposable container 36″ × 36″ × 5″. Two small, parallel, steel spacer cables near the coil bottom connect each coil loop to accept dispensing forces and guarantee a 24 inch separation between coils. In addition, two slack plastic straps located near the top of the coils function as trip wires, increasing obstacle effectiveness. GPBTO can be dispensed manually and by vehicle. Manual emplacement is accomplished by staking one end of the obstacle to the ground, then backing away with the container. With this manual pull force on the spacer wires, the barbed tape is pulled from the container, loop by loop, to form a relaxed unit entanglement, 20 meters long and 30″ high. The total unit weight with container is less than 35 pounds for hand emplacement. Hand emplacement takes about four minutes per unit. The GBTO design includes the capabilities of attaching the spacer wires of several units together in their packaged form in such a way that a continuous barrier several units long can be dispensed by vehicle with no field assembly. GPBTO is shipped in the vehicular dispenser that includes eight connected units of barbed tape. Three vehicular dispensers are dispensed side by side, simultaneously, from a moving vehicle to form a complete obstacle seven and one-half feet wide and approximately 160 meters long in about two minutes. A three coil deep GPBTO obstacle provides approximately five times more delay to an upright man than Triple Standard Concertina. To date, no individual has been able to crawl through a three coil deep GPBTO obstacle. Also GPBTO can be recovered for reuse in a matter of minutes. Currently GPBTO is nearing completion of Military Potential Tests (MPT) at Fort Knox, Kentucky. Standardization is expected to be accomplished by March 1973. At that time GPBTO will be an expendable supply item and will be procured and stocked dependent on demand from the Continental Army Command and various Theater Commanders.

- Explosive Kit, Foxhole Digger was developed by MERDC to assist the frontline combat soldier in rapidly attaining below ground protection in a foxhole. After four years in the development stages, it was type classified in 1966. The device consists of two separate kinds of explosive charges—a shaped charge and a cratering charge. The shaped charge is used more initially to blast a pilot hole through the hard surface. Then the cratering charge is inserted into the pilot hole and allowed to fall to the bottom. Placement in the bottom of the pilot hole optimizes the configuration of the resulting cratered foxhole. The device is seven inches long and weighs one pound; of which 60 percent is explosive weight. Shaped like a small artillery shell, the aid is carried on a soldier's belt or shoulder strap. To operate it, two delay-type fuzes, a spike or stability rod, and a cratering charge are removed from the approximately seven by two inch plastic cylinder that serves as a container in transit. With the addition of the spike to anchor it to the ground and one of the fuzes, the container becomes a charge. This detonates 30 seconds after the soldier presses the firing button on the fuze to form a pilot hole in the ground. The 30 second delay allows the soldier to retire to a safe distance (15 yards). The cratering charge is then assembled, activated, and placed into the pilot hole. Thirty seconds later, it explodes to loosen the soil and make digging with the soldier's intrenching tool much easier. In use, this device permits digging a foxhole in one-third the time required for digging one by conventional means. It is particularly valuable in use against surface-frozen ground. Since standardization this item has not been procured for stock.

- Antitank Mine Dispensing System (ATMDS) is a set of simple, lightweight mechanical equipment designed for rapidly emplacing M–15 mines. This equipment will place mines on or under the surface of the ground at the average rate of 385 mines per hour. The rate varies with the rythm of work of the three mine handlers in the tow truck under local conditions. The ATMDS includes mine cache equipment consisting of conveyors, mine containers, and special tools, which are designed for an assembly line operation to rapidly process the deboxing, fuzing, and containerizing of the mines at a rear location. The lifting fork is useful when trucks are rapidly loaded with the preloaded palletized containers of mines. The Antitank Mine Dispenser is a two wheeled trailer with a side life moldboard that slices through the ground and raises it. The mines slide under the raised furrow. The soil flows over the rear of the moldboard to its original position, providing satisfactory camouflage in tillable soils. It can be towed by any cargo truck (2½ ton capacity or larger) or the M–548 tracked truck. The ATMDS is transportable slung under a helicopter. The heavy labor tasks are done by the equipment while manual dexterity accomplishes the more intricate jobs. With the ATMDS about one-fourth of the number of men are used for similar manual mine laying tasks. In this case, most of the soldiers are working in the mine cache to the rear rather than in the forward minefield. The austere ATDMS was developed by MERDC to meet the need for rapidly installing the smaller tactical minefields. However, several of them can replace the previous Mechanical Mine Planter in producing large strategic minefields without the requirement for so much support. The new Antitank Mine Dispensing System also requires very little technical training or sophisticated maintenance.

- The Overhead Cover for Foxhole was developed by MERDC to support 18 inches of indigenous soil over an emplacement cut into the surface of the terrain while maintaining the strength characteristics to withstand the blast effects of a nuclear explosion. A single unit can cover a one or two-man foxhole, and can be combined in multiple to cover the shelter portion of a crew-served weapons emplacement. The foxhole cover (OCF) is a woven dacron fabric laminated to 0.5 mil polyester film. It is five feet-four inches long by six feet wide. Connected to each side of the 6-foot width are tubular sections, six inches in diameter and sixty-four inches long. It comes packaged at a net weight of 1.95 pounds for its 5.5 by seven-inch size. The OCF uses a semi-buried soil anchorage to keep the fabric taut across the foxhole. Shallow anchor trenches are dug six feet long on each side of the foxhole and six feet apart. The tubular sections are filled with soil and placed in the shallow anchor trenches. Backfill is placed over the fabric to a depth of 18 inches. The backfill is initially placed over the anchor tubes and soil shoulders, and finally over the foxhole itself. It will cover as much as five feet of the foxhole. Multiple units are connected by snap fasteners. The joints are as strong as the base fabric. The OCE can be used as an expedient ground cloth, a litter or as protection from chemical agents. Accepted for standardization in 1970, it will be stocked and issued on the basis of demand.

Getting back to the role of the divisional engineer, barrier and obstacle planning is developed concurrently with other defensive plans. The operations section, G3, has staff responsibility for the tactical employment of barriers and obstacles, but the staff engineer has the special staff responsibility for their planning.

The overall engineer responsibility for staff planning includes—

- Planning and supervising all engineer activities.
- Developing terrain studies and reconnaissance information.
- Preparing portions of the barrier/denial plan.
- Assisting in the development of the logistics estimate.
- Coordinating the efforts of civilian and indigenous labor.
- Recommending and supervising the allocation of engineer resources.
- Locating and determining the effectiveness of individual obstacles and targets.

In addition to special staff planning, the engineers furnish assistance in the form of affort, advice and technical supervision. They may have the additional responsibility for the siting and construction of obstacles when special skills and equipment are required, when flanks and rear are exposed, when the obstacles must be prepared before the position-occupying troops arrive or when the construction lies beyond the capability and responsibility of a particular subordinate unit. The construction of obstacles for close defense is the responsibility of the unit commander involved, and may be integrated into a barrier plan of division or higher echelon. Normally, each tactical unit is responsible for the construction of the obstacles of that part of a barrier system which lies within its area of tactical responsibility.

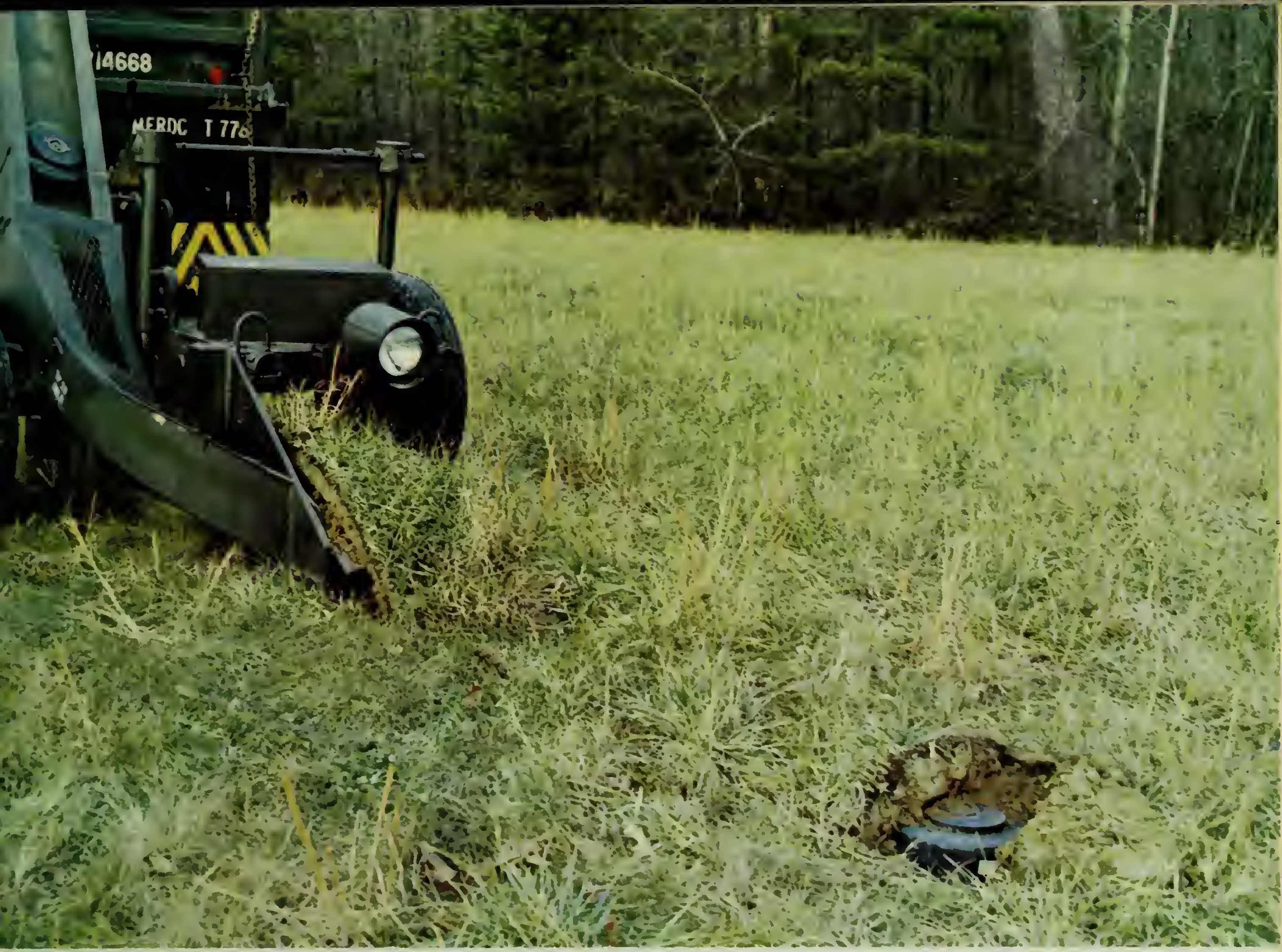
The defense is built around a series of organized and occupied tactical positions which are selected for their natural defensive strength, their potential enhancement of the defensive mission, and the fields of observation might afford. These natural positions are strengthened by field fortifications to support the fire plan and the scheme of maneuver. The siting and construction of field fortifications for the protection of the troops is the responsibility of the individual unit commander. The staff engineer is responsible for the production of terrain intelligence studies from which the fortifications are planned and developed. The engineer's primary responsibilities in the construction of field fortifications are to—

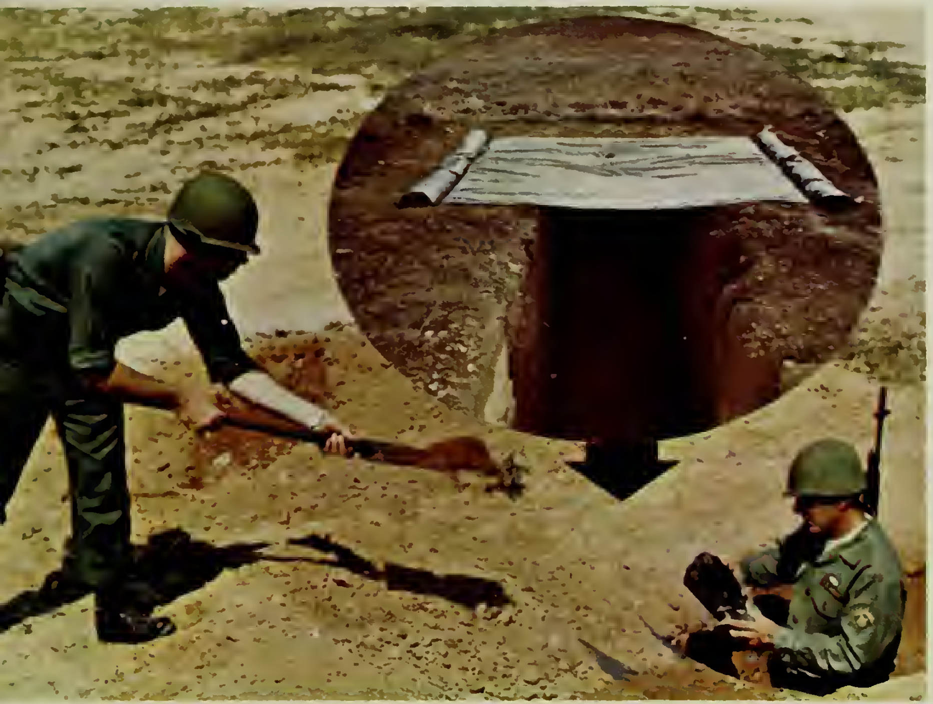
- Recommend the amounts and types of field fortification materials and equipment such as hand tools needed by the division.
- Furnish technical advice and assistance
- Accomplish large-scale excavation and backfilling
- Increase the effectiveness of extensive emplacements through the creation of protective obstacles
- Furnish special engineer tools and equipment with operators
- Prefabricate emplacement and shelter components or modules for using units and protective construction for unit command and communication facilities.

The engineers are responsible for the planning, construction, repair and maintenance of all routes required to permit movement of reserves to counterattack or to blocking positions, and for bypasses arounds defiles. This responsibility includes all combat roads and tactical bridging. Contingency planning should include anticipated enemy action to interdict movement of reserve echelons by attacks against roads, defiles and bridging.

The role of the divisional engineers in defensive operations is a significant and critical one. How the unit leadership and technical expertise is applied and utilized by the division and brigade staffs is many times the decisive factor in determining success or failure in a tactical area of operations where the foot soldier is extensively deployed in fire support bases and base camps.

Major L. A. Schmidt is presently assigned to the U.S. Army Engineer School at Fort Belvoir, Virginia, as Chief of the Engineering and Tactical Bridging Division, Department of Applied Engineering. A graduate of the United States Military Academy at West Point, N.Y., the Major holds a masters degree from Purdue University. He has served tours in Germany and Vietnam, and only recently completed work at the Command and General Staff College at Fort Leavenworth, Kans.





Pictured here are (above) the Anti-Tank Mine Dispensing System, the Explosive Foxhole Digger Kit (right) and the Overhead Foxhole Cover (below).

THE HENRY LARCOM ABBOT AWARD

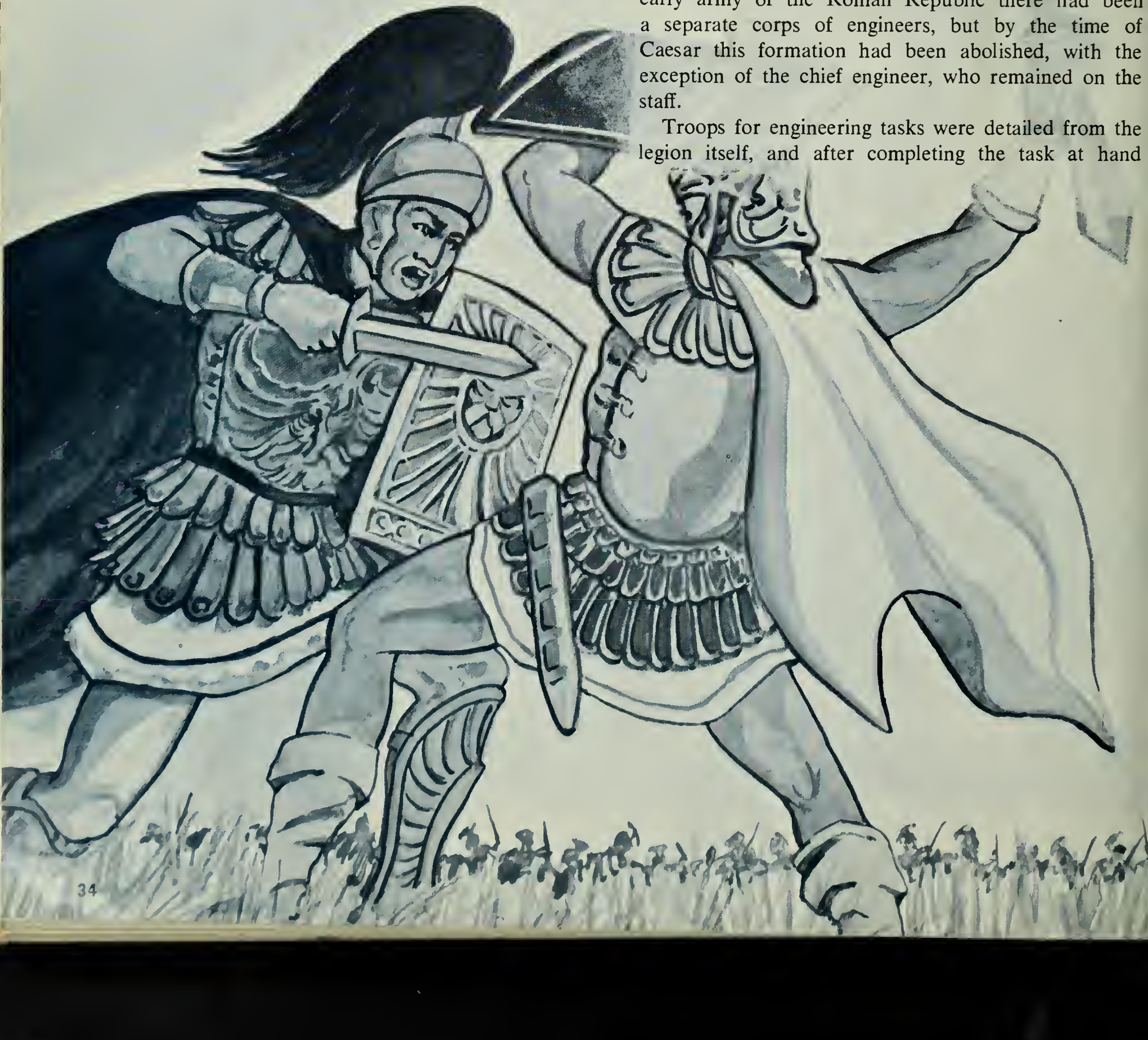
CAESAR'S ENGINEERS

Captain James M. Smith

Imagine that we are standing on the bank of a large river. The Army commander has decided on a show of force against hostile units located across the river we are observing. Since bridging assets are not available, expedient bridging methods are being used and the river, which is about a quarter of a mile wide at this point, has been bridged in just under 10 days. The bridge is a 40 foot wide timber tressle. As we watch, the first elements of the army cross and begin the advance into hostile territory. Have we been observing a combat action in World War II, Korea, or Vietnam? No, none of these. The action described took place in 55 B.C. The river bridged was the Rhine, near modern Cologne. Julius Caesar, in command of the Roman Army, used the bridge to cross the Rhine, and to recross it after subduing two revolting Germanic tribes, and then had the bridge dismantled.

The illustration points up the fact that although the Roman Army is usually depicted as an infantry force, it actually had considerable engineer capability. In the early army of the Roman Republic there had been a separate corps of engineers, but by the time of Caesar this formation had been abolished, with the exception of the chief engineer, who remained on the staff.

Troops for engineering tasks were detailed from the legion itself, and after completing the task at hand



they were returned to the ranks. The average Roman soldier, or legionary, was no stranger to what we would call combat engineering duties. The Roman Army believed strongly in field fortifications, which in the absence of power tools had to be constructed entirely by hand.

Doctrine for the army in hostile territory called for the construction of a fortified camp at the end of each day's march. The "type" camp was large enough to accomodate two legions, and required an area of about 2,000 by 2,600 feet. Of course this size might vary depending upon the size of the force or the relative safety of the area. The camp was surrounded by a ditch and by a rampart or wall made of the material taken from the ditch. The sizes of the ditch and wall varied greatly, but the ditch was usually about 12 feet wide at the top, 10 feet deep, and three feet wide at the bottom. The wall was from five to 12 feet high and from six to 10 feet broad at the top. A few simple calculations will show that this requires moving a considerable amount of earth, all done with hand tools. Yet trained Roman troops could complete a typical camp in from two to five hours, depending on the ground.

River crossing operations also called for engineering skills and again the legionary was equal to the task. The army usually preferred to ford streams, since fording required no preparation, but when this was not practical, bridges had to be constructed. These ranged from trees felled across a gap to the bridges built across the Rhine. These timber tressle bridges were remarkably like those constructed by modern armies. Floating bridges were also constructed using boats, and the Romans seem to have experimented with inflatable bridging using animal skin floats inflated with bellows.

Another task calling for large amounts of engineer work was the siege of fortified towns or cities. Roman doctrine for siege operations called first for the construction of a series of trenches and fortified positions surrounding the city, thus cutting it off from outside aid and supply. The city could then be assaulted directly or by more elaborate methods. If assaulted directly, scaling ladders were built, covered breaching huts were constructed and material was collected to fill in ditches or moats. All this was accomplished by legionaries detailed for the work, under the supervision of the chief engineer.

If direct assault was impossible, then more elaborate methods would be used—methods requiring considerable engineer work. Large siege towers were constructed and moved into place. Work was then started on an agger—a large ramp which would extend to the top of the defenders wall. The agger was constructed largely of wood and work began just out of missile range. It was built in stories, each story starting just out of hostile missile range and extending as close as possible to the enemy fortifications. Workmen were protected by moveable walls as they came into missile range. Each story was connected to the next by steps or ladders.

When the agger had reached the height of the enemy fortifications, the space between it and the city wall was rapidly filled with rubbish, bundles of straw, stones, and other debris, and the assault was made over the wall. Aggers were constructed up to 80 feet high, over 200 feet wide, and several hundred feet long. This was quite a feat for engineers equipped with only hand tools.

Other engineering tasks were the construction of seige engines such as catapults, which shot large arrows, and ballistae, which threw large stones. This heavy artillery of the Roman army was usually carried in a baggage train and assembled when needed. At times, however, it had to be constructed on the spot.

What equipment did the legionary have available to accomplish these engineering tasks? A combat engineer of today would be familiar with most of the tools used by Caesar's engineers, for they were equipped with the common shovel, ax, sledge hammer, and saw that make up the pioneer kit of today. Of course, powered equipment was not available, so the legionary made do with baskets to transport earth, shovels to dig and load, and his own two feet as organic transportation. Much of the equipment was transported in a horse drawn baggage train, but some of the tools, especially those for construction of the army's march camp were carried by the individual legionary. And since he was an infantry soldier first, it was in addition to sword, shield, spear, and his personal belongings. With full combat gear the legionary had a load of from 30 to 70 pounds, which he rolled in a bundle and carried attached to forked stick over his shoulder. He was expected to march on the average 16 or 17 miles a day and to work on the fortification of the camp at the end of the day's march.

The Romans were considered the outstanding engineers of the ancient world (they were the first to use concrete in large building projects) and we can see that these engineering skills extended to their military forces as well. So, the next time you happen to read the Latin motto on your unit crest, give a thought to the Roman combat engineer—he was a damn fine engineer. ℮

Captain James M. Smith is a recent graduate of the Engineer Officer Advanced Course at Fort Belvoir, Virginia. He was recently presented the Henry Larcom Abbot Award for excellence in writing based on his presentation of "Caesar's Engineers."

Bridging

CRANE OPERATOR TRAINING OFFERED AT LEONARD WOOD

THE ENGINEER TRAINING CENTER at Fort Leonard Wood, Missouri, is offering two crane operator courses for enlisted personnel taking Advanced Individual Training. One course, the 730-62F20 course, is oriented to training for use of the hook block and the other course, the 730-62F30 course, includes the shovel, backhoe, and other attachments. Reserve unit commanders are cautioned to consider the difference when individuals are selected for crane operator training.

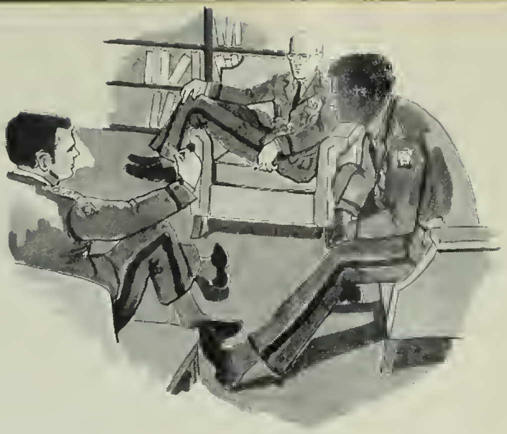
USAES INTRODUCES COMPANY COMMANDER'S PREPARATORY COURSE

IN AN EFFORT TO BRIDGE the so-called "company-level gap" in the army officer educational system, the Engineer School has recently proposed the Company Commander's Preparatory Course and received CONARC'S blessing for the plan to administer this course by correspondence. The course is designed as an interim measure to assist both potential and active company commanders by furnishing them with instructional material in subject areas that are pertinent to the efficient discharge of their responsibilities. Sixty-two credit hours of instruction is included in the course to provide the company commander with a comprehensive knowledge of personnel management, military justice, company administration, supply, maintenance, intelligence fundamentals, training management and contemporary issues (race relations and drug abuse). Correspondence Courses provide students with a highly flexible mode of study with the inherent advantage of working at their own speed whenever the opportunity presents itself. Unlike most other courses the Company Commander's Prepartory Course is comparatively short and can be completed in a few weeks during the student's spare time. Interested personnel may enroll by submitting a completed DA Form 145, Army Correspondence Course Enrollment Application, thru channels to the Commandant, U.S. Army Engineer School, ATTN: DNRI, Fort Belvoir, Virginia 22060.

OFFICER RECORD BRIEF BECOMES A REALITY FOR CORPS PERSONNEL

ENGINEER BRANCH HAS REVIEWED all of the Officer Record Briefs for second lieutenant through colonel. Some of these have been audited, but many have not. Phase I of the ORB-DA Form 66 audit was scheduled for those personnel who were not in student or transient status, and excluded OBV lieutenants. Phase II of the audit is now underway to accomodate those excluded in Phase I. Then, beginning in November of 1973, a reissue of everyone's ORB should cover anyone who was not able to audit his record during Phase I or II. The Officer Record Brief replaced your Engineer Branch copy of the DA Form 66. Once Branch receives your ORB, your DA Form 66 is closed out and it becomes an historical document in your 201 file. Your ORB then becomes the primary source document for assignment actions and as such should be audited with care for accuracy now and yearly (birthdate month) in conjunction with your friendly neighborhood officer personnel section.

the Gap



REQUIREMENTS EXIST FOR LONG TOUR ASSIGNMENTS AND EXTENSIONS OVERSEAS

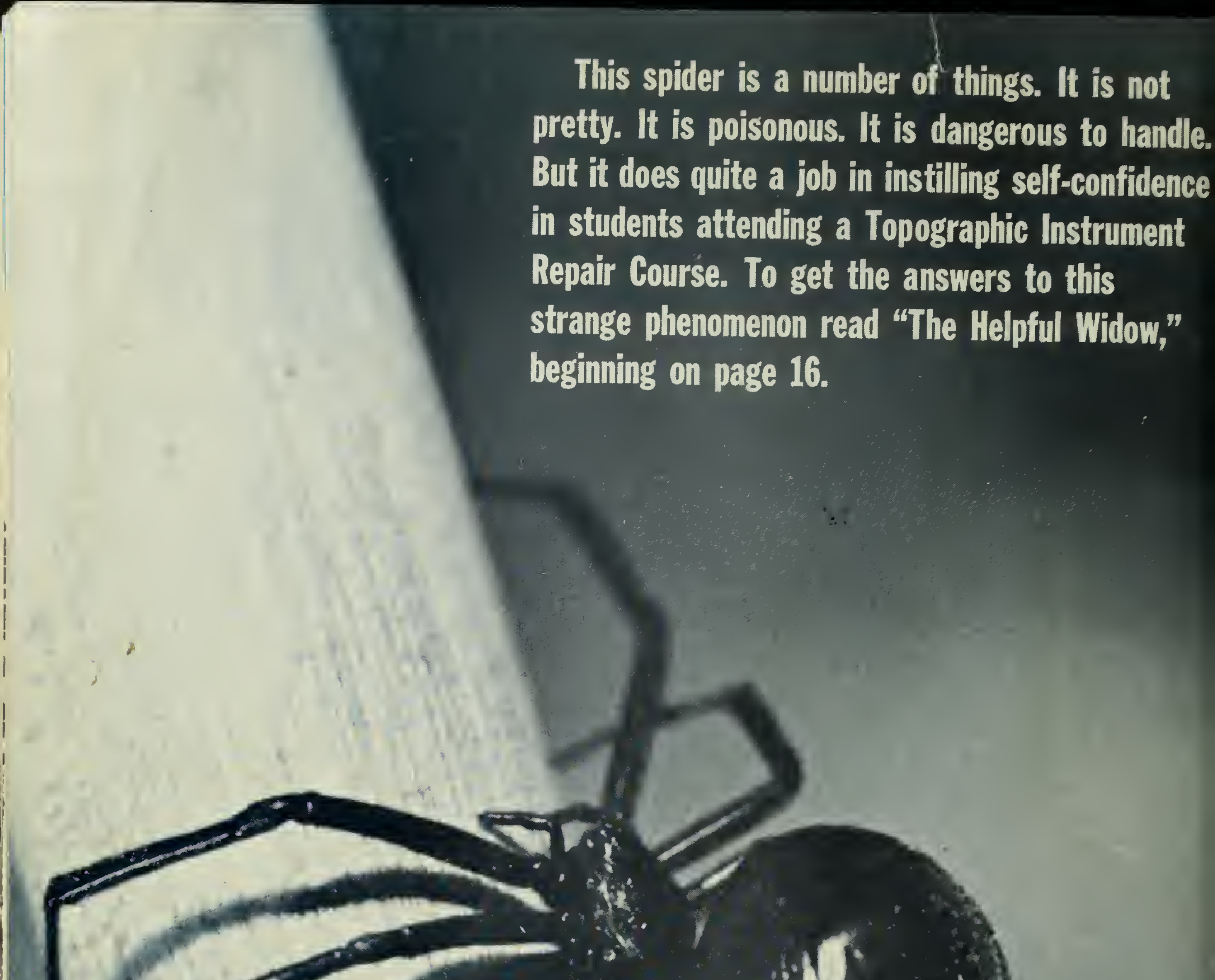
OPO DA ADVISES that they continually have requirements for such long tour areas as Europe, Hawaii, Panama, Ethiopia, Turkey, and Okinawa. To be eligible, officers in CONUS must have served at least 24 months on station at the time of departure, while officers in overseas areas must complete their current tour. In *all* cases the officer must have sufficient time remaining on his obligation to complete the full prescribed tour. Requests must be submitted in writing *through channels* in accordance with AR 614-30. As for extending, DA allows extensions in oversea areas to maintain strengths in particular grades and MOS's and to reduce personnel turnover whenever possible. Although the current trend is for longer tours, requests are not automatically approved because some degree of equity in the distribution of less desirable assignments must be observed. When reviewing requests for extensions OPO DA gives major consideration to the strength of the command in grade and MOS; overall strength of the command; priority of the commnd in comparison with other areas; overall strength of the MOS in which the extension is requested; and the recommendation of the commander. Major overseas commanders have the authority to disapprove requests for extensions within their commands, hence the emphasis on submitting such requests through channels. Extensions for foreign service tours are granted for periods up to twelve months. With the exception of certain intelligence-related MOS's, personnel may, subject to DA approval, voluntarily serve up to five years in an oversea command.

DA NAMES 23 "NONCOMS" TO ATTEND NCOES ADVANCED COURSE IN FY '73

THE ADVANCED COURSES of the Noncommissioned Officer Education System (NCOES), which were initiated in January, 1972, are designed to prepare personnel in grades E6 and E7 to perform duty as "noncoms" in grades E8 and E9. A Department of the Army Selection Board selects the personnel that will attend the advanced courses. It picked 23 sergeants first class to attend the Construction Foreman NCO Advanced Course at Fort Belvoir, Virginia, during the early part of Fiscal Year 1973. They are Sergeants First Class Joseph Acello, Jr., Charles O. Adams, Goldman N. Anothy, Bela M. Csejtey, Ernest L. Dilley, Robert S. Dolan, Leslie J. Easley, Raymond Farris, Alfred C. Fisher, Richard I. Gerner, Delbert M. Hundley, Joseph L. Jessee, Ralph E. Hohnson, Glen W. Linville, James A. McGee, Sr., Vernon McIlvain, Dean C. Phillip, Jr., Willis J. Ralls. Donald M. Scaff, Charles R. Sheible, Frederick J. Snider, Tommy L. Stanfill, and James B. Strickland.

FIRST SERGEANT DUTY ASSIGNMENTS EXTENDED TO TWO-YEAR TOURS

IN ITS CONTINUING EFFORT to increase stabilization in assignments of key noncommissioned officers, the Department of the Army has extended assignments of personnel performing duties as First Sergeants to 24 months, with a minimum tour of 18 months. Such action will also provide a greater degree of continuity in the relationship of First Sergeants to their soldiers, and to the organization to which they are assigned. Noncommissioned officers desiring to be assigned as First Sergeants are encouraged to volunteer for such duty through use of the Enlisted Preference Statement (DA Form 2635), indicating their preference in Item 15 of the form.



This spider is a number of things. It is not pretty. It is poisonous. It is dangerous to handle. But it does quite a job in instilling self-confidence in students attending a Topographic Instrument Repair Course. To get the answers to this strange phenomenon read "The Helpful Widow," beginning on page 16.

BOUND BY
HNM

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